



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

2

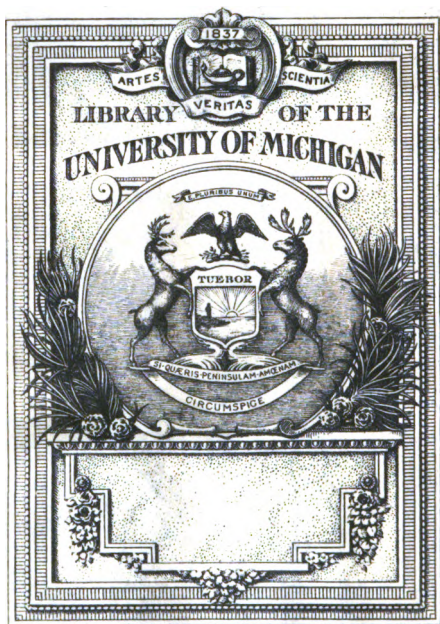
11



No 39

QA
10
P32

Amos



ben
ne
v

William S. S.

658



William Burton's
Book



William Burton
1840

RECOMMENDATIONS.

PHILADELPHIA ACADEMY,

November 2nd 1801.

Altho' Treatises on the Elements of Arithmetic heretofore composed, or compiled, be numerous, and in the view of many, competent to the proposed purposes of instruction; there is, doubtless, yet room for several improvements, both in regard to sufficiency of matter, and clearness of arrangement, as also, accommodation to the manner of computing in the United States. Herein, the Author of the present intended publication, appears to have employed much industry, and to have considerable merit.

SAML. MAGAW,

JAS. ABERCROMBIE, } Directors.

Having perused the *Preceptor's Arithmetic*, I think it a work, which, on account of the arrangement and simplicity of the Rules, a judicious choice of Examples, and the insertion of several useful subjects, seldom met with in books of the size, is well calculated for the instruction of Youth, and an advantageous Assistant to the Preceptor. J. CRAIG, teacher of the Mathematics,

Nov. 18th, 1801.

Friends' Academy.

I have perused the *Arithmetic* of J. Paul, with as much attention as my time and other circumstances would admit; and am of opinion, that it will be found better calculated for learners, than any other now in this country. JARED MANSFIELD, late Preceptor

of Languages, Friends' Academy.

New Haven, Nov. 10, 1801.

The *American Preceptor's Assistant*, appears to me a valuable System of Arithmetic, and peculiarly well adapted to our own country. The variety of judicious practical Questions, suited to the capacities of learners, which it contains, will, I think, be found exceedingly useful. The want of such familiar Examples, is a capital defect in most works of this kind.

JAMES A. NEAL, Principal of the Young Ladies' Academy, Philadelphia.

Nov. 18th, 1801.

I have perused the specimen of the *Preceptor's Assistant*, which was put into my hands; and am of opinion, the work contains some very useful additions and improvements upon treatises of a similar nature that are generally in use.

BENJ. TUCKER.

2d, 11mo. 1801.

I have examined the *Preceptor's Assistant* by J. Paul, and must acknowledge, that I am highly pleased with it as a System of Arithmetic. The arrangement appears to be judicious, and the examples well chosen. In my opinion, its introduction into our schools, would tend to facilitate the progress of the learner, and to lessen considerably the labor of the Teacher.

Nov. 15, 1801.

ROBERT GETTY.

I have examined the *American Preceptor's Assistant*, and believe it to be well calculated for the use of schools; and am of opinion, it will prove highly beneficial.

S. REYNOLDS.

November, 20th, 1801.

I have examined the *American Preceptor's Assistant*, with as much care as my time would permit, and am of opinion; that teachers who take it in use, will find it to answer the purposes for which it is designed, better than any other work of the kind now in circulation among us.

Nov, 26th, 1801.

D. JAUDON.

I have perused the *American Preceptor's Assistant*, and do think it is the best of the kind I ever saw; therefore, I recommend it as such. W. M'CREA, A. M.

Having examined the *American Preceptor's Assistant* compiled by J. Paul, I recommend it as superior, in divers respects, to any treatise of arithmetic now in general use.

28th 10mo. 1801.

BENJ. KITE.

Having perused the *American Preceptor's Assistant*, I think it a work highly meriting the patronage of the public. Taking it collectively, I consider it preferable, in point of practical utility, to any of the same size heretofore published.

TITUS BENNETT.

3d 11 mo. 1801.

After inspecting the *American Preceptor's Assistant*, am of the sentiment, that the arrangement of the rules both simple and compound, wherein the right hand examples prove the left: the method adapted respecting federal money; the introduction of policies of insurance; some useful instruction in the measurement of carpenter and masons' work, &c. together with a concise but plain treatise on gauging; cannot fail rendering it a useful and acceptable work to teachers throughout the United States.

JESSE WATERMAN,

10th 11 mo. 1801. Teacher of English and French,

No. 147, Chestnut-Street.

THE
AMERICAN
PRECEPTOR'S ASSISTANT:

CONTAINING A SYSTEM OF
PRACTICAL ARITHMETIC;

ADAPTED TO THE CAPACITIES
OF YOUTH.



COMPILED BY JEREMIAH PAUL.

SO TEACH US TO NUMBER OUR DAYS, THAT WE MAY
APPLY OUR HEARTS UNTO WISDOM. PSALMS 90, 12.



PHILADELPHIA:
PRINTED BY THO. L. PLOWMAN.
.....
1801.

COPY-RIGHT SECURED.

Math.
Travel
10-1-23

PREFACE.

AS the following treatise is not intended to lessen the merit of any preceding work of the kind, but principally to simplify the rules of the science, and furnish the pupil with familiar and suitable examples; if it should, in these respects, claim any preference to other systems, I flatter myself, that the public, and my fellow teachers particularly, will favor it with their patronage: and to their decision, I respectfully submit the work.

The tables inserted in reduction, by some authors, are, in this treatise, omitted; as they swell the book to little purpose: The pupil being thoroughly acquainted with the tables in Compound Addition, would supersede the necessity for the tables in that rule. The three last cases in Vulgar Fractions, and Combination of Numbers, are also omitted; the uselessness of which, and a desire to make room for things of greater utility, without increasing the price of the book, being thought a sufficient apology for their suppression. Some useful information, therefore, respecting Carpenter and Mason's work, is added; which cannot fail of being acceptable to youth apprenticed to these callings. But as to these, and some other advantages, which I hope this treatise will be found to possess, and the mode adapted respecting federal money in the several rules, the public decision will be the best criterion.

Besides the ordinary rules in books of this kind, I have inserted Policies of Insurance, taken principally from Pike's Arithmetic; I have also added, a concise Treatise on Gauging. This being an amusing, as well as neces-

art, and seldom introduced into books of this kind, cannot fail of being acceptable to teachers in general.

Having said thus much, it may not be amiss to add, that there are, no doubt, errors of the pen and press; but the candid will pass a favorable construction upon what is almost impossible to avoid in a work of this nature. Such detections, however, or any hint of improvement, communicated to me, should a second impression be encouraged, will be gratefully received.

J. P.

EXPLANATIONS OF CHARACTERS.

SIGNS.	SIGNIFICATIONS.
=	equal; as $20s. = 1\text{ } \text{£}$.
+	more; as, $6 + 2 = 8$
—	less; as, $8 - 2 = 6$
×	into, with, or multiplied by; as, $6 \times 2 = 12$
÷	by (i. e. divided by) as, $6 \div 2 = 3$; or $2)6(3$
: ::	proportionality; as, $2 : 4 :: 6 : 12$
$\sqrt{\quad}$	Square Root; as $\sqrt{64} = 8$
$\sqrt[3]{\quad}$	Cube Root; as, $\sqrt[3]{64} = 4$
$\sqrt[4]{\quad}$	Fourth Root; as, $\sqrt[4]{64} = 2$, &c.

ARITHMETIC.

ARITHMETIC is that science which treats of the properties, powers, and operations of numbers. It has five primary rules.....viz. Numeration.....Addition..... Subtraction.....Multiplication.....and Division.

NUMERATION.

NUMERATION teaches how to read any number of figures which may be written; and also to express, by figures properly arranged, any number of figures which can be conceived. The characters used in calculations are 1 one.....2 two.....3 three.....4 four.....5 five.....6 six7 seven.....8 eight.....9 nine.....0 cipher.

TABLE :

Units.....	Tens.....	Hundreds.....	Thousands.....	X of thousands.....	C of thousands.....	Millions.....	X of millions.....	C of millions.....
1.....One								
2 1.....Twenty-one								
3 2 1.....Three hundred twenty-one								
3 2 1.....4 thousand 321								
3 2 1.....54 thousand 321								
3 2 1.....654 thousand 321								
3 2 1.....7 million 654 thousand 321								
3 2 1.....87 mill. 654 thousand 321								
3 2 1.....987 mill. 654 thous. 321								
7 8 9.....123 mill. 456 thons. 789								
6 9 1.....483 mill. 572 thous. 691								

The above table is thus briefly comprised and enlarged:

<p>C thousand of millions..... X thousand of millions..... Thousands of millions.....</p>	<p>C of millions..... X of millions..... Millions.....</p>	<p>C of thousands..... X of thousands..... Thousands.....</p>	<p>Hundreds..... Tens..... Units.....</p>
<p>1 2 3 9 8 7 6 7 8 {</p>	<p>9 8 7 1 2 3 4 8 3 {</p>	<p>6 5 4 4 5 6 5 7 2 {</p>	<p>3 2 1 7 8 9 6 9 1 {</p>
<p>Thous. millions</p>	<p>Millions</p>	<p>Thous.</p>	<p>Units.</p>

Although the preceding table is sufficient in practice, yet the following may not be unnecessary :

Nonillions. Octillions. Septillions. Sextillions. Quintillions.

654321 987654 321987 654321 987654

Quadrillions. Trillions. Billions. Millions. Units.

321987 654321 · 98654 321987 654321

Billions are substituted for millions of millions,..... Trillions for millions of millions of millions..... Quadrillions for millions of millions of millions of millions, &c.

EXAMPLES:

Set down in figures the following numbers:

Nine hundred and five.

Twelve thousand and ninety.

Two hundred eighty thousand, ~~seven~~ hundred:

Ninety-seven million, five hundred forty-one thousand eight hundred and seventy-two.

Seven hundred sixty-four thousand millions, eight hundred ninety-five millions, two hundred thirty-one thousand, eight hundred and seventy-nine.

In words express these numbers:

478 70904 49163189186
3010 4091876 500098400700

Numbers are also thus denoted, and are called numeral letters, or Roman numbers:

1.....2.....3.....4.....5.....6.....7.....8.....9.....10.....
 I II III IV V VI VII VIII IX X
 20.....30.....40.....50.....60.....70.....80.....90.....100.....
 XX XXX XL L LX LXX LXXX XC C
 500.....1000.....1798.....
 D M MBCCXCVIII

A less numeral number, placed after a greater, augments its value; but placed before it, diminishes it: thus,

VI 6.....IV 4.....XI 11.....IX 9.....CX 110.....XC 90

ADDITION OF INTEGERS.

ADDITION of integers is the collecting of several numbers, of the same denomination, into one sum; as 12, 6, and 6, added, make 26.

RULE.

Place the numbers so, that units be under units, tens under tens, &c. Then add the right-hand column, setting down the units of the result, carrying the left-hand figure to the next column. Proceed in this manner, setting down the whole result at the last.

TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	5	6	7	8	9	10	11	12	13	14
3	5	6	7	8	9	10	11	12	13	14	15
4	6	7	8	9	10	11	12	13	14	15	16
5	7	8	9	10	11	12	13	14	15	16	17
6	8	9	10	11	12	13	14	15	16	17	18
7	9	10	11	12	13	14	15	16	17	18	19
8	10	11	12	13	14	15	16	17	18	19	20
9	11	12	13	14	15	16	17	18	19	20	21
10	12	13	14	15	16	17	18	19	20	21	22
11	13	14	15	16	17	18	19	20	21	22	23
12	14	15	16	17	18	19	20	21	22	23	24

EXPLANATION.—The sum of any two numbers in the top line and left-hand column, is found directly under the one of them opposite the other—as, 9 and 8 make 17.

If young beginners would learn to repeat this table perfectly by memory, they would not stumble, as many do, at the very threshold of the science.

PROOF.

Add downwards: Or, set down the sum of the first column—likewise the sum of each other, the unit figure under, the tens to the left in the upper line—the sum of the whole will equal the first total.

In all the succeeding examples, through the four primary rules, both simple and compound, the one at the right hand is intended, when wrought, to prove that on the left.

EXAMPLES.

Yards.	Gallons.	Shillings.	Pounds.
4362	7165	8375	7462
5638	2835	7462	8375
7685	2837	6378	2174
2837	7685	3622	7826
<hr/>	<hr/>	<hr/>	<hr/>
Sum 20522			
<hr/>	<hr/>	<hr/>	<hr/>
12222			
830			
<hr/>	<hr/>	<hr/>	<hr/>
Proof 20522			
<hr/>	<hr/>	<hr/>	<hr/>
£.47256	£.34189	£.82756	£.81753
52744	67825	17244	18247
67825	71632	54628	67152
34189	28368	45372	32848
<hr/>	<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>	<hr/>
£.27563215		£.84627853	
82754926		15372147	
71638543		42718689	
28361457		57281311	
67810524		82754926	
32189476		27563215	
<hr/>		<hr/>	
<hr/>		<hr/>	

PRACTICAL QUESTIONS.

1. If £.7685. £.632. £.98. £.7642. £.28. and nine thousand and seventy-two pounds be added, what is the sum?

Answer.....£.25157.

2. A person born in the year 1688, in what year will he be 112 years of age?

Answer.....in 1800.

3. A bond is due for £.8973. interest thereon £478. what is the amount?

Answer.....£.9451.

4. A person has due to him on bond, £.1084. in book accounts £.9865. in sundry notes £.107. and in cash £.1794. what is the whole sum?

Answer.....£.12850.

5. How many strokes does a regular clock strike in a week?

Answer.....1092.

6. A draper bought six pieces of linen, three of which contained each 76 yards, the other three each 68 yards—the number of yards is required?

Answer.....432.

7. If from the creation to the flood be 1650 years, from that time to the calling of Abraham 427, from that to the building of the temple 909, thence to the founding of Rome 266, thence to the birth of Christ 752, and since 1801—the age of the world is required?

Answer.....5805.

8. A person left his widow £.5850. his eldest son £.4828. to two other sons each £.3500. to three daughters each £.2565. and in charitable bequests £.1086. the sum bequeathed is required?

Answer.....£.26459.

9. The lesser of two numbers is 9087, their difference twice as many and 198—what is the greater number?

Answer.....27459.

10. A grocer bought 8 casks of sugar, No. 1 and 2 weighed each 1087 lbs. No. 3, 4, and 5, each 1278 lbs. No. 6, 7, and 8, each 1456 lbs.—the whole weight is required?

Answer.....10376 lbs.

11. Bought 10 bales of linen, in four of which were 65 pieces, which contained 1625 yards, the other 6 had 95 pieces and 2375 yards—how many pieces and yards were there?

Answer.....160 pieces, 4000 yards.

12. Borrowed a sum of money; paid £.389. £.576. £.1274. £.2488. and the residue unpaid is £.273. query, the sum borrowed?

Answer.....£.5000.

13. A person left his son 1725 dollars more than his daughter, whose portion was 15 thousand 15 hundred and 15 dollars—query, the son's part, and the whole estate?

Son.....18240 doll.

Estate.....84755 doll.

14. If from Philadelphia to New-York be 97 miles, from thence to Fishkill 69, thence to the Halfway-House 85, thence to Crown-Point 125, thence to Montreal 209, and from thence to Quebec 70 miles,—what is the distance between Philadelphia and Quebec?

Answer.....655 miles.

SUBTRACTION OF INTEGERS.

SUBTRACTION of integers is the finding the difference between two given numbers, of like denomination; the greater of which is called the minuend, and the less the subtrahend.

RULE.

Place the less number under the greater, with units under units, &c. Begin at the right hand, and take the value of the lower figure from that above it, and set down the remainder; but if the lower figure be the greater, mentally add 10 to the upper figure, and subtract from that sum, noting the excess, and carry 1 to the next figure of the subtrahend, and so proceed.*

PROOF.

The sum of the remainder and subtrahend, must equal the minuend: Or, the remainder taken from the minuend, leaves the subtrahend. Addition and subtraction, both simple and compound, mutually prove each other.

EXAMPLES.

Yards.	Galls.	Shillings.	Pounds.
From 81275	74216	904176	830275
Take 42087	35028	481638	307737
Remains 39188	39188		
Proof 81275	35028		

* The table in addition may be usefully applied in this rule; thus, the difference between any number in the table and those in the left hand column, may be seen at the top; as, the difference between 17 and 9, is 8.

274631	875410	902103	716250
108716	709495	510782	324929
<hr/>	<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>	<hr/>

978074321612	782017637413
480267504378	284210820179
<hr/>	<hr/>
<hr/>	<hr/>

PRACTICAL QUESTIONS.

1. Borrowed £.7426. paid £.4987. what remains unpaid? Answer.....£.2439.

2. A person born in the year 1689, what was his age in the year 1800? Answer.....111;

3. What difference is there between the age of A, born in 1739, and that of B, in 1762? Answer.....24 yrs.

4. What sum is that which, being added to £.194189. will make £.218028.? Answer.....£.23839.

5. America was discovered by Columbus in 1492, and its independence declared in 1776, what number of years were there between those periods? Answer.....284.

6. There are four numbers, the first 917, the second 912, the third 1229, and the fourth as many as the other three, lacking 299, their sum is required?

Answer.....4617.

7. Bought 6 casks of sugar, three of which weighed each 978lbs. tare each 38lbs. the other three each 1058lbs. tare 45lbs. each—what quantity in pounds neat?

Answer.....5853.

8. Bought 24 pipes of brandy, containing 3024 gallons, of which were sold 18 pipes, containing 2268 gallons—how many pipes and gallons were left?

Answer.....6 pipes, 756 gallons

9. A bond for £.1087. on which was interest due £.224. payments endorsed thereon for £.487. and £.572. what sum is yet remaining? Answer.....£.252.

10. Borrowed £.10000. paid at sundry times £.2786. £.3928. £.946. and £.1088. what remains unpaid?

Answer.....£.1252.

11. A merchant, at his first engaging in trade, owed £.937. he had in cash £.1755. in goods £.459. in good debts £.197. and he cleared the first year £.249. what was his neat balance at the year's end? Answer.....£.1723.

MULTIPLICATION OF INTEGERS.

MULTIPLICATION of integers is the taking of any proposed number, of any denomination, called the multiplicand, as many times as there are units in another proposed number, called the multiplier—and the number produced by this operation, is called the product. The multiplicand and multiplier are sometimes called factors.

TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

CASE I.

When the multiplier does not exceed 12, or when it is the exact product of two factors in the multiplication table;

RULE,

Place the multiplier under the unit figure of the multiplicand; multiply the several figures in succession; set down the units, and carry the tens, setting down the whole result at the last.

If the multiplier exceed 12, multiply by one of the factors, and that product by the other.

PROOF.

Multiply half the multiplicand by double the multiplier;
Or, multiply double the multiplicand by half the multiplier;
Or, reject the sum of the nines from the sum of each factor (added sidewise) and multiply the remainders together; from the result of which (added as before) reject 9, if it occur, and note the excess. Then add the figures of the product, as before, rejecting the nines; the last excess will be equal to that found above.*

EXAMPLES.

1. Multiplic. 86786	43393	173572	Pr
Multiplier 4	doub. mult. 8	half mult. 2	5
			8 X 4
Product 347144	Proof 347144	Proof 347144	5

2. Multiply 647321854
By 3

3. 323660927
6

4. 765478292
4

5. 382739146
8

6. 902763548
5

7. 451381774
10

8. 991687599
7

9. 771312577
9

10. 27168132528
11

11. 24904121484
12

* This method of proof, although much used, is not to be entirely depended upon; for the excesses will often correspond when the answer is erroneous. They, however, will never fail to agree, when the work is right.

12. Multiply 47862548
By 32 4

8

13. Multiply 23931274
By 64 8

8

14. Multiply 81947626
By 72 6

9

15. Multiply 40973813.
By 144 12

12

CASE II.

When the multiplier consists of a number not in the table;

RULE.

Multiply by each figure, as in the last case, omitting ciphers, and put the first figure of the product directly under its multiplier; the sum of these will be the product required.

Ciphers to the right of the factors, annex to the product.

When the multiplier is some number between 12 and 20, multiply by the units thereof, adding to each product the figure of the multiplicand which is next to the right of that multiplied. See Ex. 11, 12.

When the multiplier consists of many figures, it frequently happens, that individual figures thereof are the aliquot parts of two or more figures to the left of them; in which case the work may be abbreviated by multiplying the product of the former, by such part, for the product of the latter. See Ex. 13 to 18.

EXAMPLES.

1. Multiply 6357534
By 47

44502738

25430136

Facit 298804098

2. Multiply 3178767
By 94

$$\begin{array}{r} 3. \text{ Multiply } 3760410 \\ \text{By } 4840 \\ \hline \end{array}$$

$$\begin{array}{r} 4. \text{ Mult. } 1880205 \\ \text{By } 9680 \\ \hline \end{array}$$

$$\begin{array}{r} 5. \text{ Multiply } 54321 \\ \text{By } 12345 \\ \hline \end{array}$$

$$\begin{array}{r} 6. \text{ Mult. } -12345 \\ \text{By } 54321 \\ \hline \end{array}$$

$$\begin{array}{r} 7. \text{ Multiply } 987654 \\ \text{By } 456789 \\ \hline \end{array}$$

$$\begin{array}{r} 8. \text{ Mult. } 456789 \\ \text{By } 987654 \\ \hline \end{array}$$

$$\begin{array}{r} 9. \text{ Mult. } 11696344950 \\ \text{By } 109436064 \\ \hline \end{array}$$

$$\begin{array}{r} 10. \text{ Mult. } 5848172475 \\ \text{By } 218672129 \\ \hline \end{array}$$

$$\begin{array}{r} 11. \text{ Mult. } 674821596 \\ \text{By } 15 \\ \hline 10122323940 \end{array}$$

$$\begin{array}{r} 12. \text{ Mult. } 562351330 \\ \text{By } 18 \\ \hline \end{array}$$

$$\begin{array}{r} 13. \text{ Mult. } 2786513 \\ \text{By } 728 \\ \hline \end{array}$$

$$\begin{array}{r} 14. \text{ Mult. } 5573026 \\ \text{By } 364 \\ \hline \end{array}$$

$$\begin{array}{r} 22292104 \times 9 \ 8 \ 7 \ 2 \\ 200628936 \\ \hline 2028581464 \end{array}$$

$$\begin{array}{r} \times 9 \ 4 \ 3 \ 6 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 15. \text{ Mult. } 55701262 \\ \text{By } 162324 \\ \hline \end{array}$$

$$\begin{array}{r} 16. \text{ Mult. } 27830801 \\ \text{By } 324648 \\ \hline \end{array}$$

$$\begin{array}{r} 17. \text{ Mult. } 472856548 \\ \text{By } 248364218 \\ \hline \end{array}$$

$$\begin{array}{r} 18. \text{ Mult. } 236428274 \\ \text{By } 496728426 \\ \hline \end{array}$$

PRACTICAL QUESTIONS.

1. If 85 men pay each £.398. what is the whole sum?
Answer.....£.33830
2. If 13578 be multiplied by 4938, what is the product?
Answer.....67048164.
3. A floor is 105 feet in length, and 46 in breadth; the number of feet therein is required? Answer.....4830.
4. Bought 342 bales of linen, in each bale 56 pieces, and in each piece 25 yards; how many pieces and yards were there? Answer.....19152 pieces, 478800 yds.
5. Sold 6 casks of sugar, 3 of which weighed 978lb. tare each cask 38lb. the others each 1056lb. tare each 45lb. required the neat weight in lbs. Answer.....5853lbs.
6. What sum of money must be divided among 36 men, so that each may receive 155l.?
Answer.....£.5580.
7. There are two numbers, the greater of them is 25 times 78, and their difference 9 times 15, their sum and product are required?
Answer.....sum 3765, product 3539250.
8. A merchant began trade with 25327 dollars. The first 6 years he cleared 1253 dollars per annum, the next 5 he cleared 1729 dollars per annum; but the last 4 years had the misfortune to lose 3019 dollars per annum what was he worth at the 15 years' end?
Answer.....29414 dollars.
9. A draper bought 6 pieces of linen, three of which contained each 76 yards, the other three each 68 yards; the number of yards is required? Answer.....432.
10. Bought 47 pieces of Russia sheeting, each piece containing 36 ells; of which were sold 25 pieces: the whole number of ells is required, and the number of pieces and ells left?
Answer.....

{	Ells.....	1692.
	Pieces left..	22.
	Ells left....	792.
14. If the sacred writings contain 403 leaves, each leaf 4 columns, each column 73 lines, and each line average 34 letters; how many letters are contained in these writings?
Answer.....4000984.

DIVISION OF INTEGERS.

DIVISION of integers is the reverse of multiplication, and shows how often a less number is contained in a greater of like denomination, and what remains. It has four parts, viz. a dividend, or sum to be divided—a divisor—a quotient, which is the result of the operation—and the remainder, if any, which must be less than the divisor, and which always retains the same name with the dividend.

It consists of two kinds, viz. short division and long.

SHORT DIVISION.

Short division is, when the divisor does not exceed 12,

RULE.

See how often the divisor is contained in the fewest left-hand figures of the dividend, and place the quotient figure under; if any remain, conceive it to be prefixed to the next figure of the dividend, and see how often the divisor is contained therein; and so proceed with every figure of the dividend.*

If the divisor consist of the product of two factors in the multiplication table, divide first by one of them, and that quotient by the other. And, for the true remainder, to the product of the first divisor with the last remainder, add the first remainder.

PROOF.

Multiply the quotient by the divisor, adding to the product the remainder, if any.

Multiplication and division, both simple and compound, mutually prove each other.

* The multiplication table may be considered as a division table also; thus, any figure in the left-hand column, as a divisor, into any opposite number in the table, as a dividend, the quotient appears above: as, 7 into 56 quotes 8; 9 into 108, gives 12,

C

EXAMPLES.

- | | | | |
|-----|--------------------|-----|--------------------|
| 1. | Dividend. | 2. | |
| | Divisor 2)78694786 | | 4)157389572 |
| | Quotient 39347393 | | |
| | 8 | | |
| | Proof 78694786 | | |
| 3. | 3)874168294 | 4. | 6)1748336587 |
| | | | |
| | | | |
| 5. | 4)768542184 | 6. | 8)1537084368 |
| | | | |
| | | | |
| 7. | 5)980764788 | 8. | 10)1951520500 |
| | | | |
| | | | |
| 9. | 7)138836250 | 10. | 9)178503780 |
| | | | |
| | | | |
| 11. | 11)553770230 | 12. | 13)385031160 |
| | | | |
| | | | |
| 13. | 21 { 3)10273531044 | 14. | 42 { 6)20547062088 |
| | 7) | | 7) |
| | | | |
| | | | |

$$\begin{array}{r}
 15. \quad \left\{ \begin{array}{l} 7) 51423324120 \\ \hline 56 \left\{ \begin{array}{l} 8) \\ \hline \\ \hline \end{array} \right. \\ \hline \end{array} \right.
 \end{array}$$

$$\begin{array}{r}
 16. \quad \left\{ \begin{array}{l} 7) 102846648240 \\ \hline 112 \left\{ \begin{array}{l} 8) \\ \hline 2) \\ \hline \end{array} \right. \\ \hline \end{array} \right.
 \end{array}$$

LONG DIVISION.

Long division is, when the divisor exceeds 12.

RULE.

See how often the divisor is contained in the fewest left hand figures of the dividend, the result of which place to the right thereof for the first quotient figure; the product of this figure, with the divisor, place under the said figures for a subtrahend: subtract, and to the remainder annex the next figure; find a second quotient figure as before; and so proceed.

Omit ciphers to the right hand of the divisor in the operation, separating as many figures from the right of the dividend, which annex to the remainder.

PROOF.

As in short division.

Or, the dividend, less the remainder, divided by the quotient, will give the divisor.

Or, the remainder, added with the subtrahends, as they stand in the operation, will equal the dividend.*

* This way is rather ineligible, as it may appear to prove, and the work be erroneous; yet it will always prove, if it be right.

EXAMPLES.

Div.	Divid.	Quo.		
72,0)	983682,9	(13662	36,00)	491841,45(13662
73	720		36	3600
<hr/>	<hr/>		<hr/>	<hr/>
263	273329		131	8197200
216	95635		108	40986
<hr/>	<hr/>		<hr/>	<hr/>
.476	9836829 proof		238	49183200
.432			216	945
<hr/>			<hr/>	<hr/>
..448			224 pf.	49184145
..432			216	
<hr/>			<hr/>	<hr/>
...162			81	
...144			72	
<hr/>			<hr/>	<hr/>
....189 rem.			945	
<hr/>			<hr/>	<hr/>
9836829 proof.				
<hr/>				

3. 734)647395(882 4. 882)647395(734
 5. 8197)18328612(6. 2236)18328492(
 7. 41659)756360804(8. 18156)756360804(
 9. 783751)418481384082(10. 546706)418481384082(
 11. 953676)279372844448(12. 292943)279372708468(

PRACTICAL QUESTIONS.

1. A journey of 4352 miles, is to be performed in 136 days; what number of miles is that each day?

Answer.....32 miles.

2. The expense of erecting a certain bridge came to £.10044, which is to be defrayed equally by 372 persons; what must each man pay? Answer.....£.27

3. A journey of 9855 miles, at the rate of 27 miles a day; required the number of days to perform it?

Answer.....365 days

THE AMERICAN PRECEPTOR'S ASSISTANT.

4. If a man's annual expence be 1104 dollars, what that per calendar month? Answer.....92
5. What number is that which, being multiplied 3589, will produce 184101844? Answer.....51
6. A certain tract of land, containing 40500 acres, be divided into 125 equal plantations; query, the num of acres in each? Answer.....324 a
7. The quotient of an example in division is 51296, dividend 164101344; what was the divisor? Answer.....32
8. In 478800 yards of linen, how many pieces and bale each piece to contain 25 yards, and each bale 56 pieces? Answer..... { Pieces.....191
Bales.....3
9. A cistern, containing 14976 gallons, is emptied in hours by 48 equal vents; what quantity is discharged each in that time, and how many gallons per hour, admitting the velocity of the fluid to be uniform? Answer..... { Galls.....3
per hour,....
10. What number is that which, being multiplied 12345, will produce 670592745? Answer.....543
11. One of the factors, in an example in multiplication 987654, the multiplicand 451149483006; the other factor is required. Answer.....4567
12. If Captain Drake, when he sailed round the world which is reckoned 25020 miles, made good 30 miles every day; in what time did he complete his circumnavigation? Answer.....Years 2 : 104 da

COMPOUND ADDITION.

COMPOUND Addition is the adding of several sums of different denominations, into one sum; as pounds, shillings and pence; yards, qrs. and nails, &c.

RULE.

Put like denominations under each other; add the right hand column, as in whole numbers, and divide the sum

as many as make one of the next greater denomination ; set down the remainder, and carry the quotient to the next ; and so proceed.

Where 20 is the divisor, as in shillings, cwt. &c. carry half the number of tens, prefixing the odd ten, if any, to the unit figure.

PROOF.

Add downwards : or, set down the value of the lowest column, also, the sum of each other column, the tens to the left above ; the sum of these will equal the first total.

ENGLISH MONEY.

DENOMINATIONS.

4 Farthings, marked qr. make 1 penny, marked d.
 12 Pence.....1 shilling, s.
 20 shillings.....1 pound, £.

Accounts are kept in England, and its dominions, in these denominations ; which are also much used in the American States.

TABLES.

qr.	d.	d.	s.	d.	s.	d.	s.	l.	s.
4.....1	12....1	20....1	8	20....1	8	20....1	0		
8.....2	24....2	30....2	6	30....2	6	30....1	10		
12.....3	36....3	40....3	4	40....3	4	40....2	0		
16.....4	48....4	50....4	2	50....4	2	50....2	10		
20.....5	60....5	60....5	0	60....5	0	60....3	0		
24.....6	72....6	70....5	10	70....5	10	70....3	10		
28.....7	84....7	80....6	8	80....6	8	80....4	0		
32.....8	96....8	90....7	6	90....7	6	90....4	10		
36.....9	108....9	100....8	4	100....8	4	100....5	0		
40....10	120..10	110....9	2	120....9	2	120....6	0		
44....11	132..11	120..10	0	150....7	10				
48....12	144..12	240..20	0	200...10	0				

EXAMPLES.

<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>
82	13	$3\frac{1}{2}$	36	14	$8\frac{1}{2}$	28	17	$9\frac{1}{2}$
17	6	$8\frac{1}{2}$	63	5	$3\frac{1}{2}$	71	2	$2\frac{1}{2}$
78	11	$10\frac{1}{2}$	88	12	$7\frac{1}{2}$	86	14	$7\frac{1}{2}$
85	7	$11\frac{1}{2}$	75	7	$2\frac{1}{2}$	77	5	$2\frac{1}{2}$
<hr/>			<hr/>			<hr/>		
Sum	263	19 10	263	19	10	263	19	10
<hr/>			<hr/>			<hr/>		
221	2	2	221	1	2	221	1	2
42	17	8	42	18	8	42	18	8
<hr/>			<hr/>			<hr/>		
Proof	263	19 10	263	19	10	263	19	10
<hr/>			<hr/>			<hr/>		

<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>
6486	14	$8\frac{1}{2}$	6789	12	$7\frac{1}{2}$	8321	14	$8\frac{1}{2}$
3513	5	$3\frac{1}{2}$	3210	7	$4\frac{1}{2}$	1678	5	$3\frac{1}{2}$
8789	16	$9\frac{1}{2}$	7126	11	$9\frac{1}{2}$	6821	15	$2\frac{1}{2}$
1210	3	$2\frac{1}{2}$	2873	8	$2\frac{1}{2}$	3178	4	$9\frac{1}{2}$
5688	7	$11\frac{1}{2}$	7874	1	$2\frac{1}{2}$	7853	19	$11\frac{1}{2}$
2987	19	$8\frac{1}{2}$	1802	6	$5\frac{1}{2}$	1822	7	$8\frac{1}{2}$
<hr/>			<hr/>			<hr/>		

<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>
42746	12	$8\frac{1}{2}$	74631	15	$9\frac{1}{2}$	71481	13	$11\frac{1}{2}$
57253	7	$3\frac{1}{2}$	25368	4	$2\frac{1}{2}$	28518	6	$0\frac{1}{2}$
68147	14	$2\frac{1}{2}$	78642	11	$11\frac{1}{2}$	82187	17	$10\frac{1}{2}$
81852	5	$9\frac{1}{2}$	21357	8	$0\frac{1}{2}$	17812	2	$1\frac{1}{2}$
76374	17	$10\frac{1}{2}$	78716	14	$5\frac{1}{2}$	89163	15	$6\frac{1}{2}$
23625	2	$1\frac{1}{2}$	21283	5	$6\frac{1}{2}$	10836	4	$5\frac{1}{2}$
87890	17	$10\frac{1}{2}$	76027	15	$8\frac{1}{2}$	41685	18	$9\frac{1}{2}$
14716	7	$9\frac{1}{2}$	26579	19	$11\frac{1}{2}$	60921	16	10
<hr/>			<hr/>			<hr/>		

FEDERAL MONEY.

DENOMINATIONS.

10 mills, *m.* make 1 cent, *c.*10 cents.....1 dime, *d.*10 dimes.....1 dollar, *D.*10 dollars.....1 eagle, *E.**dwt. gr.*A dime.....1 $16\frac{2}{3}$ of silverA dollar.....17 $1\frac{1}{2}$ An $\frac{1}{2}$ eagle.....5 $14\frac{1}{2}$ of goldAn eagle.....11 $4\frac{3}{4}$

The Federal standard weight, for gold and silver, is 11 parts fine, and 1 part alloy.

The banks generally, and many merchants, keep their accounts in Federal money; and for its simplicity and ease in calculation, exceeds every other method in use.

Eagles and dollars may be read together as dollars; dimes and cents, as cents; and dimes, cents and mills, as mills. The sum of the first example in page 22, may be read thus, dol. 3268, 86 cents.

TABLE,

REDUCING PENCE TO CENTS, AS THEY CURRENTLY PASS.

<i>d.</i>	<i>c.</i>	<i>d.</i>	<i>c.</i>	<i>d.</i>	<i>c.</i>	<i>d.</i>	<i>c.</i>	<i>d.</i>	<i>c.</i>	<i>d.</i>	<i>c.</i>	<i>d.</i>	<i>c.</i>
1	is 1	16	18	31	34	46	51	61	68	78	84		
2	2	17	19	32	35	47	52	62	69	77	85		
3	3	18	20	33	37	48	53	63	70	78	87		
4	4	19	21	34	38	49	54	64	71	79	88		
5	5	20	22	35	39	50	55	65	72	80	89		
6	7	21	23	36	40	51	57	66	73	81	90		
7	8	22	24	37	41	52	58	67	74	82	91		
8	9	23	25	38	42	53	59	68	75	83	92		
9	10	24	27	39	43	54	60	69	77	84	93		
10	11	25	28	40	44	55	61	70	78	85	94		
11	12	26	29	41	45	56	62	71	79	86	95		
12	13	27	30	42	47	57	63	72	80	87	97		
13	14	28	31	43	48	58	64	73	81	88	98		
14	15	29	32	44	49	59	65	74	82	89	99		
15	17	30	33	45	50	60	67	75	83	90	100		

A TABLE OF COINS, Which pass current in the United States, with their sterling and federal value.

Names of coins.	Standard weight.	Sterling money of G. Britain.	N. Hamps. Massachusetts, R. I. and Conn. Virginia.				New-York and North Carolina.				New-Jersey, Pennsylvania, Delaware, and Maryland.				South Carolina and Georgia.				Federal Value.			
			f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	f. s. d.	¢.	d.	c.	m.
(GOLD)																						
A johannes.....	18	9	3	12	0	4	16	0	6	8	0	6	0	0	4	0	0	1	6,000	0	0	0
An half johannes.....	9	0	1	16	0	2	8	0	3	4	0	3	0	0	2	0	0	1	8,000	0	0	0
A doubloon.....	16	21	3	6	0	4	8	0	5	16	0	5	12	6	3	10	0	1	4,933	3	3	3
A moldore.....	6	18	1	7	0	1	16	0	2	8	0	2	5	0	1	8	0	1	6,000	0	0	0
An English guinea....	5	6	1	1	0	1	8	0	1	17	0	1	15	0	1	1	9	1	4,667	4	6	7
A French guinea.....	5	5	1	1	0	1	7	6	1	16	0	1	14	6	1	1	5	1	4,600	0	0	0
A Spanish piffole.....	4	6	0	16	6	1	2	0	1	9	0	1	8	0	0	18	0	0	3,773	3	7	3
A French piffole.....	4	4	0	16	0	1	2	0	1	8	0	1	7	6	0	17	6	0	3,667	3	6	7
(SILVER)																						
An English or French crown.....	19	0	0	5	0	0	6	8	0	8	9	0	8	4	0	3	0	1	1,100	0	0	0
The dollar of Spain,	17	6	0	4	6	0	6	0	0	8	0	0	7	6	0	4	8	1	1,000	0	0	0
Sweden or Denmark	3.18	0	1	0	0	0	1	4	0	1	9	0	1	8	0	1	0	0	222	2	2	2
An English shilling...	3	11	0	0	10½	0	1	2	0	1	7	0	1	6	0	0	11	0	200	0	0	0
A pillaren.....	3	11	0	0	10½	0	1	2	0	1	7	0	1	6	0	0	11	0	200	0	0	0

All other gold coins, of equal fineness, at 89 cents per dw. and silver at 111 cents, per oz.

**A TABLE OF OTHER FOREIGN COINS, &c. WITH
THEIR VALUE IN FEDERAL MONEY, AS ESTAB-
LISHED BY A LATE ACT OF CONGRESS.**

	<i>E. D. d. c. m.</i>
Pound Sterling.....	0 4, 4 4 0
Pound of Ireland.....	0 4, 1 0 0
Pagoda of India.....	0 1, 9 4 0
Tale of China.....	0 1, 4 8 0
Mill-ree of Portugal.....	0 1, 2 4 0
Ruble of Russia.....	0 0, 6 6 0
Rupce of Bengal.....	0 0, 5 5 5
The guilder of the Uni- ted Netherlands.....	0 0, 3 9 0
Mark banco of Hamburg	0 0, 3 2 5
Livre tournois of France	0 0, 1 8 5
Real plate of Spain.....	0-0, 1 0 0

A five pence half-penny piece, is	6 $\frac{1}{2}$ cents.
An eleven penny.....ditto....	12 $\frac{1}{2}$
A quarter dollar.....	25
An half.....ditto.....	50
Three quarters ditto.....	75
A dollar.....	100
A French crown.....	110

EXAMPLES:

<i>E. D. d. c. m.</i>	<i>Dol. Ct.</i>	<i>Dol. Ct.</i>
41 3 4 2 8	278 37	682 36
58 6 5 7 2	721 73	317 64
67 8 9 1 7	286 49	468 95
92 1 0 8 3	713 51	531 05
67 9 8 7 3	746 37	287 63
58 8 9 8 7	522 49	981 23
<hr/>	<hr/>	<hr/>
326 8 8 6		
<hr/>	<hr/>	<hr/>

PRACTICAL QUESTIONS.

1. P is indebted to Q for two hundred and forty pounds, seventeen shillings and ten pence half-penny; R owes him £.94 13s. 6d. $\frac{1}{4}$; S, five hundred and ninety-two pounds, six shillings and eleven pence three farthings, and T, eighty-six pounds, fourteen shillings and nine pence three farthings; what sum is due to Q?

£.	s.	d.
240	17	10 $\frac{1}{2}$
94	13	6 $\frac{1}{4}$
592	6	11 $\frac{3}{4}$
86	14	9 $\frac{1}{4}$
<hr/>		
<hr/>		

2. If to £.976 18s. 11d. $\frac{1}{4}$ be added £.791 14s. 8d. $\frac{1}{2}$, and £.87 13s. 10d. $\frac{3}{4}$, what is the sum?

Answer.....£.1856 7 6 $\frac{1}{2}$.

3. Due on bond £.1098 12 10 $\frac{1}{2}$, interest £.148 18 9 $\frac{1}{2}$ required the amount?

Answer.....£.1247 11 7 $\frac{1}{2}$.

4. Laid out for sundry goods these sums, viz: £.198 16 10 $\frac{1}{2}$ £.97 12 9 $\frac{1}{4}$ £.409 11 8 $\frac{1}{2}$ and £.127 13 4 $\frac{1}{2}$; query the amount?

Answer.....£.833 14 9.

5. Bills presented for payment, viz: the brewer's £.42 9 3; the butcher's £.212 11 6; the grocer's £.97 18 10; the taylor's £.141 9 8; for rent £.75; servant's wages £.78 14 6; these expences, with £.150 more, what must be drawn to defray them?

Answer.....£.798 3 9.

6. A person left his widow £.6436, his son £.3486 15 6, his daughter £.2000, to a nephew he gave £.856 10 8, to two nieces each £.488 12 10, and for charitable purposes £.365 18 9; what is the sum of these bequests?

Answer.....£.14122 10 7.

7. A trader failing, is indebted to A. in the sum of £.1378 19 10 $\frac{1}{2}$, to B. £.1086 10 7 $\frac{3}{4}$, to C. £.296 14 8 $\frac{1}{2}$, to D. £.469 18 4 $\frac{1}{2}$, and to E. £.1009 8 11; query his whole debt?

Answer.....£.4241 12 6.

8. Sent to bank at sundry times these sums, viz: Dols. 407 46 cts.; dols. 268 74 cts.; dols. 96 10 cts.; dols. 87 56 cts.; and dols. 40 8 cts. for what sum must the bank give credit?

Answer.....dols. 899 94 cts.

9. Account of sales at vendue; for linens, dols. 346 46 cts.; calicoes, dols. 96 28 cts.; shalloons, dols. 46 90 cts.; muslins, dols. 192 30 cts.; thread, tape and buttons, dols. 11 6 cts.; required the amount of the bill?

Answer.....dols. 693.

10. Laid out at one time, dols. 147 68 cts.; at another, dols. 9 75 cts.; at a third, dols. 8 and 6 mills; and lastly, dols 2 56 cts. and 4 mills; query the whole expenditure? Answer.....dols. 168.

11. What is the federal value of a johannes, a doubloon, a moidore, an English, and a French guinea, a Spanish, and a French pistole?

Answer.....dols. 53 64 cts.

12. An English crown, a dollar, an English shilling, and a pistareen, what is their federal value?

Answer.....dols. 2. 52 c. 2 m.

TROY WEIGHT.

DENOMINATIONS.

24 grains, *grs.* make 1 penny weight, *dwt.*

20 pennyweights.....1 ounce.....*oz.*

12 ounces.....1 pound.....*lb.*

Jewels, gold, silver and liquors, are weighed by this weight.

EXAMPLES.

<i>lb.</i>	<i>oz.</i>	<i>dwt.</i>	<i>gr.</i>	<i>lb.</i>	<i>oz.</i>	<i>dwt.</i>	<i>gr.</i>
836	4	16	12	271	5	14	13
163	7	3	12	726	6	5	11
714	3	14	10	671	3	10	15
285	8	5	14	328	8	9	9
534	10	17	23	378	11	12	6
648	11	19	20	804	11	5	13

AVOIRDUPOIS WEIGHT.

DENOMINATIONS.

16 drams, *drs.* make 1 ounce, *oz.*

16 ounces.....1 pound, *lb.*

28 pounds.....1 quarter of an *c. wt. gr.*

4 quarters, or 112 *lbs.* 1 hundred weight, *c. wt.*

20 hundred weight.....1 ton. *t.*

All metals, except silver and gold, are weighed by this weight; also sugars (except loaf,) rice, allum, brimstone, copperas, flour, oat-meal, cocoa, race-ginger, chalk, log-wood, redwood, hay, iron, lead, madder, &c. but in meat, cheese, butter, &c. and rice in Carolina, the neat 100 is used.

Note. 12 particulars, make 1 dozen, *doz.*

12 dozen.....1 common gross, *gro.*

12 com. gross, or 144 doz. 1 great gross, *g. gro.*

20 particulars.....1 score, *sc.*

EXAMPLES.

T.	c.	gr.	lb.	oz.	dr.
21	11	2	14	5	10
78	8	1	13	10	6
69	4	1	12	8	7
30	15	2	15	7	9
43	19	2	27	14	15
68	17	3	16	10	12

T.	c.	gr.	lb.	oz.	dr.
62	17	1	17	9	8
36	2	2	10	6	8
49	12	3	21	11	2
50	7	0	6	4	14
41	19	2	27	15	14
70	17	3	16	9	13

APOTHECARIES WEIGHT.

DENOMINATIONS.

20 grains, *grs.* make 1 scruple, \mathfrak{z}

3 scruples.....1 dram, \mathfrak{ss}

8 drams.....1 ounce, $\mathfrak{℥}$

12 ounces.....1 pound, *lb.*

Apothecaries mix their medicines by this weight; but buy and sell by avoirdupois weight.

EXAMPLES.

Lb.	℥	℥	℥	gr.
21	5	9	1	14
76	5	6	1	6
21	3	4	0	16
78	8	0	2	4
29	11	6	2	19
68	9	7	1	17

Lb.	℥	℥	℥	gr.
76	2	5	4	12
29	9	2	1	2
41	6	4	1	15
28	5	6	1	5
34	14	4	2	12
76	1	1	1	12

LONG MEASURE.

DENOMINATIONS.

- 3 barley-corns, *b. c.* make 1 inch, *in.*
 4 inches.....1 hand, *h.*
 12 ditto.....1 foot, *ft.*
 3 feet.....1 yard, *yd.*
 6 ditto.....1 fathom, *f.*
 $5\frac{1}{2}$ yards.....1 rod, pole or perch *p.*
 40 poles, or 220 yards.....1 furlong, *fur.*
 8 furlongs, or 1760 yds...1 mile, *m.*
 3 miles.....1 league, *l.*
 60 geographic, or } miles.....1 degree, *deg.*
 69 $\frac{1}{2}$ statute..... }
 360 degrees, the circumference of the Earth.
 By this measure distances are ascertained.

EXAMPLES.

<i>deg.</i>	<i>m.</i>	<i>fur.</i>	<i>p.</i>	<i>yds.</i>	<i>ft.</i>	<i>in.</i>	<i>b. c.</i>
21	41	3	20	67	2	10	1
72	18	4	20	32	0	1	2
46	21	5	13	87	1	6	1
53	38	2	27	12	1	5	2
48	37	6	39	18	2	11	2
52	24	5	3	82	2	5	0

CLOTH MEASURE.

DENOMINATIONS.

- 2 $\frac{1}{2}$ inches, *in.* make.....1 nail.....
 4 nails.....1 quarter of a yard.....*qr.*
 2 $\frac{1}{2}$ quarters, or 10 nails...1 ell *Hamburgh*.....*E. H.*
 3 quarters.....1 ell *Flemish*.....*E. Fl.*
 4 ditto.....1 yard.....*yd.*
 5 ditto.....1 ell *English or French*.....*E. E. E. F.*
 By these, cloths, tapes, &c. are measured.

EXAMPLES.

<i>yds.</i>	<i>qr.</i>	<i>n.</i>	<i>E.E.</i>	<i>qr.</i>	<i>n.</i>
524	2	3	148	4	1
478	1	1	851	0	3
863	3	2	687	2	2
136	0	2	312	2	2
767	3	3	698	4	3
362	2	2	431	2	2

LAND MEASURE.

DENOMINATIONS.

9 square feet, *ft.* make...1 yard.....*yd.*

30 $\frac{1}{4}$ yards.....1 perch.....*P.*

40 perches in length, and 1 in breadth, 1 rood, *R.*

4 roods.....1 acre.....*A.*

By this measure is ascertained the quantity of land in any inclosure.

EXAMPLES:

<i>A.</i>	<i>R.</i>	<i>P.</i>	<i>A.</i>	<i>R.</i>	<i>P.</i>
846	3	21	278	1	32
153	0	19	721	2	8
627	2	17	398	3	22
372	1	23	601	0	18
486	3	39	478	3	27
727	2	18	733	2	30

LIQUID MEASURE.

DENOMINATIONS.

2 pints, *pts.* make...1 quart.....*qt.*

4 quarts.....1 gallon.....*gal.*

31 $\frac{1}{2}$ gallons.....1 barrel.....*bl.*

42 ditto.....1 tierce.....*tr.*

- 63 ditto.....1 hhd. of wine or brandy...*Hhd.*
 64 ditto.....1 punchcon.....*pun.*
 2 hhds. or 126 galls. 1 pipe or butt.....*pi. bt.*
 2 pipes, or 252 galls. 1 ton.....*T.*

This is used in measuring liquors.

EXAMPLES:

<i>T.</i>	<i>Hhd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pt.</i>
7	3	22	3	1
2	0	40	0	1
6	2	28	2	1
3	1	34	1	1
8	3	62	3	1
9	2	50	2	1

<i>T.</i>	<i>Hhd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pt.</i>
3	2	49	2	1
6	1	13	1	1
4	3	32	3	1
5	0	30	0	1
9	3	58	2	1
8	2	54	3	1

DRY MEASURE.

DENOMINATIONS:

- 2 pints, *pts.* make 1 quart.....*qt.*
 8 quarts.....1 peck.....*p.*
 4 pecks.....1 bushel.....*Bu.*

This measure is used for grain, fruit, salt, &c.

EXAMPLES:

<i>Bu.</i>	<i>p.</i>	<i>qt.</i>	<i>pt.</i>
27	3	6	1
72	0	1	1
68	2	4	1
31	1	3	1
82	2	5	1
67	2	7	1

<i>Bu.</i>	<i>p.</i>	<i>qt.</i>	<i>pt.</i>
46	2	4	1
53	1	3	1
87	0	2	1
12	3	5	1
84	2	6	1
65	2	6	1

TIME.

DENOMINATIONS :

60 seconds, <i>sec.</i> make.....	1 minute..... <i>m.</i>
60 minutes.....	1 hour..... <i>h.</i>
24 hours.....	1 day..... <i>d.</i>
7 days.....	1 week..... <i>w.</i>
4 weeks.....	1 lunar month..... <i>mo.</i>
13 lun. mo. 1 day and 6 hours, or	} 1 common or Julian year..... <i>yr.</i>
52 weeks 1 day and 6 hours, or	
365 days and 6 hours.....	

By this table is taught the computation of time.

Note. A common year consists of 365 days ; but every fourth, called leap year, has 366 days, excepting three centurial years in every four, which will be common years.

The year is also irregularly divided thus :

The 4th, 6th, 9th and 11th months have each 30 days.

The 1st, 3d, 5th, 7th, 8th, 10th and 12th, each 31 days.

The 2d month 28, but in leap year.....29 days.

EXAMPLES :

<i>Yr. mo. w. d. h. m. sec.</i>	<i>Yr. mo. w. d. h. m. sec.</i>
25 6 2 1 20 40 37	42 4 1 3 17 28 37
74 6 1 5 3 19 23	57 8 2 3 6 31 23
67 4 3 4 15 27 18	78 9 3 4 12 28 19
32 8 0 2 8 32 42	21 3 0 2 11 31 41
73 11 2 6 21 50 51	68 10 2 6 20 59 48
64 12 3 5 15 49 27	70 0 3 5 16 40 30

CIRCLE MEASURE.

DENOMINATIONS.

60 seconds, " make1 minute, '.

60 minutes.....1 degree, °

30 degrees.....1 sign, sig.

12 signs, or 360 degrees.....1 revolution.

This is used by astronomers and navigators.

EXAMPLES.

sig ° ' " "
 2 21 40 50
 7 8 19 10
 6 15 31 33
 3 14 28 27
 2 29 58 47
 3 21 18 59

sig ° ' " "
 3 18 28 45
 6 11 31 15
 7 16 34 17
 2 13 25 43
 1 28 49 18
 4 22 28 28

PRACTICAL QUESTIONS.

1. A goldsmith bought 4 ingots of silver, weighing 8*lb.* 10*oz.* 17*dwt.* 20*gr.* 7*lb.* 9*oz.* 18*gr.* 6*lb.* 11*oz.* 18*dwt.* and 4*lb.* 3*oz.* 21*gr.* what is the weight of the whole?

Answer.....27*lb.* 10*oz.* 17*dwt.* 13*gr.*

2. Sold the following articles, viz. a salver, weighing 52*oz.* 6*dwt.* 18*gr.* two basons, each 12*oz.* 5*dwt.* 20*gr.* three pair of salts, each 5*oz.* 10*dwt.* 14*gr.* a cream pot, 5*oz.* 18*dwt.* a tankard, 33*oz.* 12*gr.* and one dozen table spoons, weight 31*oz.* 5*dwt.* 18*gr.* the weight of the whole is required?

Answer.....163*oz.* 14*dwt.* 10*gr.*

3. Bought 6 bags of hops, weighing, No. 1, 2*C.* 3*qr.* 21*lb.* No. 2, 3*C.* 25*lb.* No. 3, 4, each 4*C.* 1*qr.* 18*lb.* No. 5, 3*C.* 1*qr.* 20*lb.* No. 6, 5*C.* 1*qr.* 22*lb.* what is the weight of the whole quantity?

Answer.....23*C.* 3*qr.* 12*lb.*

4. A merchant sells 4 hhds. of sugar; No. 1, 12*C.* 3*qr.* 22*lb.* No. 2, 15*C.* 1*qr.* 18*lb.* No. 3, 9*C.* 1*qr.* 25*lb.* No. 4, 14*C.* 2*qr.* 18*lb.* their weight is required?

Answer.....52*C.* 1*qr.* 27*lb.*

5. A druggist compounds the following medicines:— No. 1, 13 63 29 18*gr.* No. 2, 29 12*gr.* No. 3, 53 19 15*gr.* No. 4, 13 29 10*gr.* what is the weight of this mixture?

Answer.....33 63 15*gr.*

6. If from Philadelphia to Baltimore be 101 miles, 4 furlongs, 25 perches; from thence to Fredericksburg 107*m.* 3*fur.* 16*P.* thence to Richmond 68*m.* 6*fur.* 32*P.* thence to Washington 219*m.* 7*fur.* 22*P.* thence to Wilmington (S. Carolina) 131*m.* 5*fur.* 6*P.* thence to Charleston 189*m.* and from thence to Savannah 118*m.* 4*fur.* 19*P.* what is the distance from Philadelphia to Savannah?

Answer.....937 miles.

7. In 5 pieces of linen ; No. 1, 28yd. 3qr. 2n. No. 2, 36yd. 2qr. 3n. No. 3, 31yd. 1qr. 1n. No. 4, 29yd. 3qr. 3n. No. 5, 45yd. 3n. how many yards are there ?

Answer.....172 yards.

8. Bought 10 bales of Russia sheeting ; No. 1, 2, contained each 95E. 4qr. 3n. No. 3, 87E. 3qr. 2n. No. 4, 5, together, 118E. 4qr. 1n. No. 6, 7, each, 69E. 2qr. 3n. and each of the rest, 76E. 4qr. 2n. how many ells were there ?

Answer.....768E. 1qr. 1n.

9. H owns the following tracts of land : No. 1 contains 489A. 3R. 28P. No. 2, 276A. 1R. 30P. No. 3, 596A. 2R. 18P. No. 4, 309A. 3R. 34P. what number of acres does he possess ?

Answer.....1672A. 3R. 30P.

10. Sold 6 hogsheds of molasses ; No. 1, contains 109gal. 3qt. 1pt. No. 2, 114gal. 1pt. No. 3, 98gal. 2qt. No. 4, 106gal. 1qt. 1pt. No. 5, 102gal. 2qt. 1pt. No. 6, 112gal. 2qt. how many gallons were there ?

Answer.....644 gallons.

11. In 4 granaries are as follows : No. 1, 109bu. 3p. 6qt. No. 2, 98bu. 7qt. No. 3, 148bu. 2p. 5qt. No. 4, 112bu. 1p. 6qt. what number of bushels are there ?

Answer.....469bu. 1p.

12. The year is divided into 12 calendar months, thus :

The fourth, eleventh, ninth and sixth,

We thirty days to each affix ;

Each other month has thirty-one,

Except the second month alone,

To which we twenty-eight assign ;

But leap-year gives it twenty-nine :

Now sum them up and let us hear,

The days in every common year ?

Answer.....365 days.

13. From the 2d of the 3d month, to the 19th of the 11th month inclusive, how many days ?

Answer.....263 days.

14. According to scripture chronology, the creation of the world was 4004 years before Christ ; how many years have passed since that time, including the present year 1801 ?

Answer.....5805 years.

15. Three signs, 24 degrees, 45 minutes, 1 sign, 2 minutes, and 2 signs, 20 degrees, 13 minutes ; their sum is required ?

Answer.....signs 7 15°.

COMPOUND SUBTRACTION.

COMPOUND subtraction is the taking of a less sum, or quantity, of divers denominations, from a greater.

RULE.

Place the less sum, or quantity, under the greater of like name. Begin at the right hand, and take the lower number from the upper. But if the lower number be the greater, then take it from as many as make one of the next higher denomination added with the upper number; set down the remainder, and carry one to the next place; and so proceed.

Subtraction of time, agreeably to the calendar, is thus performed: Take the prior date from the latter, borrowing, when necessary, as many days as are in the month of the subtrahend, and carry as usual.

When dates are one in the old stile, and the other in the new, subtract 11 days from the difference.

PROOF.

As in integers.

OF MONEY.

	£.	s.	d.		£.	s.	d.
From	8461	12	2 $\frac{1}{4}$		9182	13	7 $\frac{1}{2}$
Take	4718	17	3 $\frac{1}{2}$		5439	18	8 $\frac{3}{4}$
	<hr/>				<hr/>		
Rem'd	3742	14	10 $\frac{1}{4}$		3742	14	10 $\frac{1}{4}$
	<hr/>				<hr/>		
Proof	8461	12	2 $\frac{1}{4}$		5439	18	8 $\frac{3}{4}$
	<hr/>				<hr/>		
	£.	s.	d.		£.	s.	d.
	64873	10	4 $\frac{3}{4}$		94167	18	1 $\frac{1}{2}$
	47196	12	8 $\frac{1}{4}$		76491	0	5 $\frac{1}{4}$
	<hr/>				<hr/>		
	<hr/>				<hr/>		

£.	s.	d.
70127	11	8½
45810	13	4½

£.	s.	d.
67416	0	1½
43099	1	9½

Dols.	cts.
4261	27
2189	38

Dols.	cts.
9824	12
7752	23

Dols.	cts.
10000	00
9148	27

Dols.	cts.
92715	16
91861	43

PRACTICAL QUESTIONS.

1. A is indebted to B in the sum of £.981 17 1½; C owes him £.793 9 8½; what is the difference?

Answer.....£188 7 4½.

2. Due on bond £.1726 11 8½, interest £.137 17 2½; paid £.1569 18 11½, what is then remaining?

Answer.....£294 9 10½.

3. What is the difference between £.1009 7 1, and the sum of £.345 13 4½ and £.571 4 8½?

Answer.....£.392 9 0.

4. A merchant, at his first entering into trade, owed £.937 15 9½; he had in cash £.1755 3 6½, in merchandise £.459 12 3½, in debts £.127 16 0; and he cleared in one year £.249 19 10½; what capital had he to commence business with the second year?

Answer.....£1724 15 10½.

5. Bill of sales at auction, viz: 5 pieces of linen, each 25 yards at 3s. 4d. per yard, 27 yards Russia sheeting at 5s. 6d.

£.20	16	8.
7	8	6.

4 pieces cloth, each 45 yards at 27s. 9d. 249 15 0.
 12 dozen handkerchiefs, at 78s. per dozen, 46 16 0.
 6 dozen umbrellas, at 37s. 6d. each, 135 0 0.
 7 waiters at 52s. 6d. 18 7 6.

Received in part of the above bill, £239 1 10.
 what is the balance? Answer.....£239 1 10.

2nd. 4th month, 1801.

6. Borrowed dollars 278 50 cents, paid dollars 196 75 cents, what remains unpaid;

Answer.....dollars 81 75 cents.

7. Laid out for merchandize, viz: in linens, dollars 278 90 cents, cloths, dollars 426 08 cents, shalloons, dollars 270, druggets, dollars 387 10 cents. Paid in part of the above, dollars 987 50 cents, required the balance?

Answer.....dollars 374 58 cents.

8. Deposited in the bank of the United States, dollars 10000; drew checks for dollars 1760 50 cents, dollars 4728 85 cents, dollars 986 24 cents, and dollars 1095 75 cents, what sum remains in bank?

Answer.....dollars 1428 66 cents.

9. From $12\frac{1}{2}$ eagles, take $12\frac{1}{2}$ dollars, more 75 cents, and what remains? Answer.....dollars 111 75 cents.

OF WEIGHTS AND MEASURES.

	lb	oz.	dwt.	gr.
From	27	6	13	11
Take	14	9	10	21

	lb	oz.	dwt.	gr.
	53	4	10	10
	40	7	7	20

	Tons.	C.	qr.	lb.	oz.
	45	12	2	17	12
	22	11	3	14	14

	C.	qr.	lb.	oz.	dwt.
	63	2	21	14	10
	40	2	18	11	12

lb	3	3	3	gr.
9	5	4	1	15
4	7	2	2	17

lb	3	3	3	gr.
11	3	7	2	10
6	5	6	0	12

deg.	m.	fur.	p.
125	47	3	27
68	44	7	25

yds.	ft.	in.	b.c.
278	1	10	1
220	2	5	2

yds.	qrs.	n.
473	2	2
248	2	3

E.E.	qr.	n.
562	3	1
337	4	2

A.	R.	P.
4721	2	21
2817	3	36

A.	R.	P.
9428	1	12
7524	2	27

Tons.	hhd.	gal.
97	2	47
49	3	46

gals.	qts.	pts.
63	2	1
15	3	0

Bu.	p.	qts.	pts.
362	1	6	0
187	2	4	1

Trs.	m.	w.	d.
491	10	0	6
317	6	3	5

d.	h.	m.	sec.
10	20	41	27
4	31	18	46

sig.	mo.	7	11
10	24	18	33
5	1	55	52

Yrs.	mo.	d.
1800	1	20
1767	2	24

Yrs.	mo.	d.
1796	4	12
1763	5	19

Yrs.	m.	d.
1799	10	10
1699	11	15

Yrs.	m.	d.
1792	6	0
1692	7	6

PRACTICAL QUESTIONS.

1. What is the difference between a silver tankard, weighing 27oz. 10dwt. 18gr. and a dozen of spoons, which weigh 35oz. 14gr?

Answer.....7oz. 9dwt. 20gr.

2. From 7C. 1qr. 10lb. 2oz. 11dr. taking 4C. 2qr. 7lb. 9oz. 8dr. what remains?

Answer.....2C. 3qr. 2lb. 9oz. 3dr.

3. Bought four casks of sugar, two of which weighed 37C. 3qr. gross, tare 3qr. 17lb. the other two each 13C. 2qr. 4lb. tare 1qr. 10lb. each; required the neat weight?

Answer.....63C. 27lb.

4. If out of 17lb. 11s 63 2d of medicine, be taken 3 parcels, each 3lb. 5s 43 1d 17gr. what is left?

Answer.....7lb. 7s 2d 9gr.

5. A man has 52m. 7fur. 32p. to travel, and having gone 27m. 7fur. 36p. the remaining distance is required?

Answer.....24m. 7fur. 36p.

6. From four pieces of cloth, each 27yd. 2qr. 3n. having sold 87yd. 8qr. 2n. how many yards are left?

Answer.....22yd. 3qr. 2n.

7. From 5 yards of cloth cutting 2yds. 2qrs. 2n. what is left? Answer.....2yds. 1qr. 2n.

8. Of 12 acres of grass, 7A. 1R. 25P. are mowed; required the part unfinished? Ans.....4A. 2R. 15P.

9. A person has several tracts of land, viz. one of 736A. 2R. 24P. another of 1000A. and a third of 248A. 3R. 36P. of which he gives to his two sons each 661A. 2R. 20P. required the part left for himself?

Answer, an equal share.

10. Bought a hoghead of molasses, containing 110 gallons, of which A, B and C, were to have $27\frac{1}{2}$ gallons each; what share had D? Answer, an equal share.

11. Out of a granary containing 1000 bushels, taking 749Bu. 3p. what is left? Answer.....250Bu. 1p.

12. A was born the 17th 9 mo. 1781; B the 10th 3 mo. 1790; the difference of their ages is required?

Answer.....8Yrs. 5mo. 23d.

13. A bond was given the 27th 2 mo. 1792, and taken up the 18th 4 mo. 1798; for what time must interest be computed thereon? Answer.....5Yrs. 10mo. 20d.

14. A was born on the 19th 6 mo. 1746; old stile; B on the 4th 6 mo. 1764, new stile; what is the difference of their ages? Answer.....17Yrs. 11mo. 4d.

COMPOUND MULTIPLICATION.

COMPOUND multiplication is, the multiplying of any sum, or quantity, of divers denominations, by any given number of integers,

CASE 1.

When the integers do not exceed 12, or when they are the exact product of two factors in the multiplication table;

RULE.

Multiply by the integers; but if they exceed 12, by the factors continually, and, in either case, divide each product by as many of that denomination as make one of the next greater; set down the remainder, and carry the quients.

In multiplying of shillings, *cwts.* &c. carry half the number of tens to the product of the pounds, tons, &c. prefixing the odd ten (if any) to the units under shillings, &c.

Multiplication of Federal money differs nothing from that of whole numbers, regard being had in dividing the product.

PROOF.

The double of the multiplicand, multiplied by half the multiplying integer; or, half the former by double the latter, will equal the first product. Or,

When the multiplier consists of two factors in the table, invert them in the operation,

EXAMPLES:

	£.	s.	d.		£.	s.	d.
Multiply	21	13	8	Doub. mul.	43	7	4
by			4	half mul. in.			2
Product	£.86	14	8	Proof	£.86	14	8

£.	s.	d.
47	18	3½
		6

£.	s.	d.
23	19	1½
		12

Dols.	Cts.
325	26
	3

Dols.	Cts.
162	63
	6

Dols.	Cts.
2461	74
	5

Dols.	Cts.
1230	87
	10

lb. oz. dwt. gr.
42 10 17 22
2

lb. oz. dwt. gr.
21 5 8 23
4

T. C. gr. lb. oz. dr.
14 17 2 25 10 14
3

T. C. gr. lb. oz. dr.
7 8 3 12 13 7
6

lb. 3 3 9 gr.
10 11 7 1 18
4

lb. 3 3 9 gr.
5 5 7 2 9
8

deg. m. fur. P.
83 48 2 16
5

yds. ft. in. b.c.
31 2 10 0
10

yds. qrs. p.
49 0 2
6

E.E. qrs. p.
24 2 3
12

A. R. P.
141 0 12
7

A. R. P.
109 2 36
9

T. Hhd. gal.
126 3 16
4

gals. qt. pt.
169 0 1
3

Bu. p. qts. pt.
43 3 2 1
7

Bu. p. qts. pt.
27 3 4 1
11

Yrs. mo. w. d. h. m. sec.
7 9 3 6 14 53 48
3

Yrs. mo. w. d. h. m. sec.
3 11 1 6 19 26 54
6

sig. ° ' " "
2 25 48 56
4

sig. ° ' " "
1 12 54 28
8

Multiply £. s. d.
2 7 6½
by 24. 4

4X6=24. 9 10 2
6

£. 57. 1 0

Multiply £. s. d.
1 3 9½
by 48. 6

6X8=48. 7 2 7½
8

57 1 0 proof.

s. d.
1. 4 yards at 6 8
3. 8 bush. at 10 3
5. 54 days at 8 3
7. 60 gallons at 11 3
9. 72 yards at 9 4½

s. d.
2. 8 yards at 3 4
4. 12 bush. at 6 10
6. 108 days at 4 1½
8. 120 gallons at 5 7½
10. 144 yards at 4 8½

CASE 2.

When the integers are not the exact product of any two factors in the table;

RULE.

Multiply continually by two such factors as come the nearest under the given number, and add to their product the value of the remainder.

EXAMPLES.

1. 29 yards at 12 8×1
 $4 \times 7 + 1 = 29$ 4

$$\begin{array}{r} 12 \\ 2 \overline{) 108} \\ \underline{24} \\ 108 \\ \underline{108} \\ 0 \end{array}$$

$$\begin{array}{r} 12 \\ 17 \overline{) 148} \\ \underline{119} \\ 128 \\ \underline{128} \\ 0 \end{array}$$

$$\begin{array}{r} 12 \\ \text{£.} 18 \overline{) 74} \\ \underline{36} \\ 38 \\ \underline{36} \\ 2 \end{array}$$

2. 58 yards at 6 4×2
 $7 \times 8 + 2 = 58$ 7

$$\begin{array}{r} 6 \\ 2 \overline{) 44} \\ \underline{12} \\ 32 \\ \underline{30} \\ 2 \end{array}$$

$$\begin{array}{r} 6 \\ 17 \overline{) 148} \\ \underline{102} \\ 46 \\ \underline{42} \\ 4 \end{array}$$

$$\begin{array}{r} 6 \\ \text{£.} 18 \overline{) 74} \\ \underline{36} \\ 38 \\ \underline{36} \\ 2 \end{array}$$

3. 43 bushels at 14 10^s 10^d

4. 86 bushels at 7 5^s 5^d

5. 76 gallons at 18 9^s 2^d

6. 152 gallons at 9 4^s 2^d

CASE 3.

When the integers exceed the product of the highest factors in the table, any number whatever.

RULE.

Multiply continually by as many tens as there are figures given, excepting the highest, and the last product by that figure; and the value of 1000, 100, &c. multiply by the figures belonging to their respective places: The collected sum of the products will be the answer.—Or,

Multiply continually by any figures, whose continual product will equal the given number. Suppose 252. $4 \times 7 \times 9 = 252$. Also, $504 = 7 \times 8 \times 9 = 504$. Ex. 3. 4.

EXAMPLES.

	s. d.		s. d.
1. 195 yards, at 13 4	5	2. 390 yards, at 6 8	
10 × 10 + 90	10	10 × 10 × 3	10
+ 5 = 195		+ 90 = 390	
6 13 4 × 9		3 6 8 × 9	
10		10	
66 13 4		33 6 8	
60 0 0		3	
3 6 8			
£.130 0 0		100 0 0	
		30 0 0	
		Proof.....£.130 0 0	

3. 252 bushels, at 17 3½	s. d.	4. 504 bushels, at 8 7½	s. d.
5. 463 yards, at 12 9½	s. d.	6. 926 yards, at 6 4½	s. d.
7. 765 gallons, at 17 6	s. d.	8. 1530 gallons, at 8 9	s. d.
9. 2463 yds. at £.2 19 6	s. d.	10. 4926 yds. at £.1 9 9	s. d.

CASE 4.

When the price of an integer is in federal money ;

RULE.

Multiply as in integers, separating two figures to the right hand when there are cents, and three, when cents and mills: the figures to the left will be dollars.

EXAMPLES.

	dols. cts.		dols. cts.
1. 6 gallons, at 2 46		2. 12 gallons, at 1 23	
6		12	
Dollars.....14 76			

	cts. m.		cts. m.
3. 16 yards, at 94 8	16	4. 32 yards, at 47 4	32
Dollars.....	15 16 8		
	cts.		cts. m.
5. 25lbs. at 45		6. 50lbs. at 22 5	
	dols. cts.		dols. cts.
7. 72 yards, at 5 78		8. 144 yards, at 2 89	
	dols. cts.		dols. cts.
9. 84 gallons, at 2 58		10. 168 gallons, at 1 29	
	dols. cts.		dols. cts.
11. 284 yards, at 3 86		12. 568 yards, at 1 93	
	dols. cts.		dols. cts.
13. 2768lbs. at 5 94		14. 5536 lbs. at 2 97	

PRACTICAL QUESTIONS.

1. Bought 9 yards of fine broad cloth, at £.2 12 6 a yard; what did it cost? Answer.....£.23 12 6.
2. Sold 120 gallons of wine, at 12s. 6d. per gallon; what is the value of it? Answer.....£.75.
3. What is the value of lbs. 336 of sugar, at 15d. alb.? Answer.....£.21.
4. At 3s. 9d. a day for boarding, &c. what is that for 365 days? Answer.....£.68 8 9
5. If the expense of a family be dol. 1 75 cts. a day, and at the year's end is saved £.294 12 6; the annual income is required? Answer.....£.534 3 1 1/2.
6. A debtor compounds with his creditors at 12s. 6d. in the pound, for £.500; what sum must he pay? Answer.....£.312 10.
7. Bought 5 pipes of wine, at 12s. 6d. a gallon; which being sold at 13s. 9d. required the prime cost, what sold for, and the gain? Answer.....{ Prime cost £.293 15 0
Sold for.....433 2 6
Gain.....39 7 6
8. Bought 12 casks of Madeira wine, gauging 1344 gallons, at 17s. 6d. a gallon; what is the value thereof? Answer.....£.1176.

9., John Johnston, To William Williams, Dr.
1801, 2d mo. 1st.

For 5 pieces linen, each 25 yds. at 3s. 4d. per yd. £.

27 yds. Russia sheeting, at 5s. 6d.

4 ps. cloth, each 45 yds. at 27s. 9d.

12 doz. handkerchiefs, at 28s. per doz.

6 doz. umbrellas, at 37s. 6d. each,

7 waiters, at 52s. 6d. each,

Received in part for the above articles, £. 289 5 0

Query the balance? Answer, £. 188 18 8.

10. Wine at dol. 1 50 cts. the gallon, what is that for 2 pipes? Answer, Dols. 378.

11. If a person expend dol. 1 75 cts. per day, how many dollars is that in a year? and what sum in pounds?

Answer, } Dols. 638 75
£. 239 10 7½

12. What does a servant earn his master in seven years, working six days in a week, at 33 cents a day, one leap year included? Answer, Dols. 723 36 cts.

13. If a person's annual income be £500, and his daily expense 2 dols. 50 cts, what does he lay up at the year's end? Answer, £. 157 16 8.

14. Bought 5 chests of tea, weight neat 504 lb. at 75 cents a pound, which being sold at 83 cents a lb. what was gained thereby? Answer, Dols. 40 32.

15. Philadelphia, 2nd 4th mo. 1801.

James Jones, Bought of Livingston & Co.
Dols. cts. Dols. cts.

Viz. 45 yds. Russia sheeting, at 1 12 per yd.

32 ps. Barcelona handkfs. at 5 45

6 doz. case knives, at 1 52

2 pair andirons, at 5 60

6 Windsor chairs, at 1 25

13 yds. Padua soy, at 1 46

12 ps. Nankeens, at 1 18

Received in part 88 dols. 38 cts. what remains unpaid?

Answer, Dols 88 38 cts.

COMPOUND DIVISION.

COMPOUND division is the reverse of compound multiplication; and consists of divers denominations divided by any proposed number of integers. It also discovers the price of an integer, when a quantity and its value are given.

CASE I.

When the divisor does not exceed 12; or, when it is the exact product of two factors in the multiplication table;

RULE.

Divide by the integers, placing the quotient underneath; the remainder, multiply by the integers of the next lower name, adding in the integers of that name: divide as before, and so proceed.

If the divisor consist of two figures, divide first by one factor, as above directed, and that quotient by the other.

Where 20 is an integer of the next denomination, as in shillings, cwt. &c. call each one remaining two tens, and if there be ten in the shillings, &c. add 1, and continue the process.

PROOF.

By compound multiplication.

EXAMPLES.

1. Divide £.479 17 9½ by 2. 2. Divide £.959 15 7 by 4.

$$\begin{array}{r} \text{£. s. d. } \frac{1}{2} \\ 2 \overline{) 479 \ 17 \ 9\frac{1}{2}} \end{array}$$

Facit. 239 18 10½

2

Proof. £.479 17 9½

$$\begin{array}{r} \text{£. s. d.} \\ 4 \overline{) 959 \ 15 \ 7} \end{array}$$

239 18 10½

4

£.959 15 7

3. Divide £7846 18 11½ by 3. 4. Div. £.15693 17 10½ by 6.

5. Divide Dls.987 86cts. by 4. 6. Div. Dls.1975 72cts. by 8.

7.

lb.	oz.	dwt.	gr.
2)85	9	15	20

8.

lb.	oz.	dwt.	gr.
4)171	7	11	16

9.

T.	c.	gr.	lb.	oz.	dr.
3)25	17	3	22	14	11

10.

T.	c.	gr.	lb.	oz.	dr.
6)51	15	3	17	13	6

11.

lb.	3	3	gr.
4)9	11	6	2 16

12.

lb.	3	3	gr.
8)19	11	5	2 12

13.

Deg.	m.	far.	poles.
3)150	48	1	10

14.

Tds.	feet.	in.	b. c.
10)308	0	8	2

15.

Yds.	qr.	n.
6)323	2	2

16.

Ells E.	qr.	n.
12)645	0	0

17.

Act.	7.	per.
7)1536	0	24

18.

Act.	7.	per.
9)1975	0	8

19. $T. \text{ hhd. gal.}$
 $4)507 \ 0 \ 4$

20. gals. qt. pt.
 $5)634 \ 1 \ 1$

21. $Bu. P. \text{ qts. pts.}$
 $7)293 \ 2 \ 5 \ 1$

22. $Bu. P. \text{ qts. pts.}$
 $11)461 \ 1 \ 7 \ 1$

23. $Yrs. \text{ mo. w. d.}$
 $3)85 \ 12 \ 3 \ 5$

24. $Yrs. \text{ mo. w. d.}$
 $6)171 \ 12 \ 3 \ 3$

25. $\text{sig. } ^\circ \quad ' \quad ''$
 $4)5 \ 21 \ 37 \ 52$

26. $\text{sig. } ^\circ \quad ' \quad ''$
 $8)11 \ 13 \ 15 \ 44$

27. Div. £.71 15 7½ by 15. 28. Div £.215 6 10½ by 45.

15 $\left\{ \begin{array}{l} \text{£. s. d.} \\ 3)71 \ 15 \ 7\frac{1}{2} \\ 5)23 \ 18 \ 6\frac{1}{4} \end{array} \right.$

45 $\left\{ \begin{array}{l} \text{£. s. d.} \\ 5)215 \ 6 \ 10\frac{1}{2} \\ 9) \end{array} \right.$

£.4. 15. 8½ facit.

29. Div. £.52 10 0 by 28. 30. Div. £.105 0 0 by 46.

31. Div. £.474 0 0 by 72. 32. Div. £.948 0 0 by 744.

CASE 2.

When the divisor consists of any number not in the table :

RULE.

Divide by the given number; multiply the remainder by as many of the next lower denomination as make one of that, adding in those of that name, if any, divide as before; and so proceed. Or,

Any numbers continually multiplied, producing the number given, may be used for divisors, and the answer obtained by short division. Ex. 9—10.

To find the price of a pound, when the value of one or more *cwt.* is given—divide by the *cwt.* then by 8, 7 and 2, continually.

If there be $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ given with the integers, multiply both the price and quantity by 4, and divide by the rule.

EXAMPLES.

1. Divide $\begin{array}{r} \text{£. s. d.} \\ 67 \ 16 \ 11\frac{1}{2} \end{array}$ by 29. 2. Div. $\begin{array}{r} \text{£. s. d.} \\ 135 \ 13 \ 11 \end{array}$ by 58.

$\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 39) 67 \quad 16 \quad 11\frac{1}{2} (2 \quad 6 \quad 9\frac{1}{2} \text{ fecit.} \end{array}$

58

9

20

196

174

22

12

275

261

14

58

51.

①

3. Divide $\begin{array}{r} \text{£. s. d.} \\ 10 \ 10 \ 0 \end{array}$ by 112

81

7) 1 6 3

2) 3 9

1 10 $\frac{1}{2}$ facit :

4. Di. 349 3 9½ by 234½

4

238

E. S. D.
149 3 94

4

939)1396 15 3(1 1 9

239

facit.

457 &c.

5. Divide £.120 17 4 by 74. 6. Div. £.241 14 8 by 148.
 7. Divide £.47 10 1½ by 172½. 8. Div. £.95 0 3 by 345½.
 9. Divide £.315 0 0 by 672. 10. Div. £.630 0 0 by 1344
 $672=6 \times 8 \times 7 \times 2$ $1344=6 \times 8 \times 7 \times 4$.
 11. Divide £.105 0 0 by 10 12. Divide £.210 0 0 by
 cwt. and then tell the price 20 cwt. and then tell the
 per lb. price per lb.

CASE 3.

When the value of the given quantity is in Federal money;

RULE.

Divide as in integers, separating the quotient for cents, or cents and mills, as in case 4, compound multiplication.

EXAMPLES.

- | <i>Dols. Cts.</i> | <i>Dols. Cts.</i> |
|----------------------|-------------------|
| 1. Divide 987 86 | 2. Divide 1975 72 |
| by 4) ——— | by 8) ——— |
| <i>Dols. 246 965</i> | |
| ————— | ————— |

3. Divide 672 *D.75cts.* by 25. 4. Div. 1345 *D.50cts.* by 50.
 5. Div. 8930 *D.50ct.* by 106. 6. Div. *dols.* 17861 by 212.
 7. Div. 6861 *D 12cts.* by 336. 8. Div. 13722 *D.24cts.* by 672

PRACTICAL QUESTIONS.

1. A man has £.3 7 6 for twelve days service; what is that a day? Answer.....5s. 7½d.
2. Sold 24 yards of cloth, for £.36 12; what was it a yard? Answer.....£.1 10 6.
3. Sold 1344 gallons of wine, for £.1176; the price of one gallon is required? Answer.....17s. 6d.
4. What is a day's salary, at £.300 a year? also, how much a week? Answer.....
 { Daily, £.0 16 5½+.
 { weekly, £.5 15 0½+.

5. What is the quotient of £.1000, divided by 176

Answer.....£.5 13 7½.

6. Bought 5 pieces of cloth, each 20 yards, for £.188 6s. 8d. what was it a yard? Answer.....£.1 17 8

7. A man left £.1000 to his wife and three sons, thus: his wife to have $\frac{1}{3}$, the eldest son $\frac{1}{4}$, and the residue to the others equally; what is each one's legacy?

Answer..... { Wife.....£.333 6 8
eldest son...£.250 0 0
others each £.208 6 8

8. Divide £.3371 17 0 thus; give A $\frac{1}{2}$, B $\frac{1}{3}$, and C the rest.

Facit..... { A, £.1685 18 6
B, £.1123 19 0
C, £.561 19 6

9. A person bequeathed his estate of £.8684 18 9 thus; to his wife $\frac{2}{3}$, to his son $\frac{1}{3}$, and the residue to his daughter: the share of each is required?

Answer..... { Wife.....£.3473 19 6
son.....£.2894 19 7
daughter..£.2315 19 8

10. If an estate of £.9937 17 6 be divided in this manner; the widow to have $\frac{1}{3}$, the eldest son $\frac{1}{4}$, an only daughter $\frac{1}{5}$, and the residue equally among three other sons; what is the share of each?

Answer..... { Widow....£. s. d.
3312 12 6
eldest son 2484 9 4½
daughter..1987 11 6
others each 717 14 8½

11. When 100 gallons of wine are sold for 226 dollars, what is it a gallon? Answer.....Dols. 2 26cts.

12. If 58lb. of loaf sugar be sold for Dols. 14 56cts. what is it a lb? Answer.....26Cts.

13. Bought 288lb. of coffee, for Dols. 57 60cts. how much was it a lb? Answer.....20Cts.

$$288 = 4 \times 8 \times 9$$

14. If 3Cwt. of Imperial tea be sold for Dols. 681 34cts. what was it a lb? Answer.....Dols. 1 94cts.

15. A donation of Dols. 787 50cts. is given to be equally divided among 210 poor persons; what is the share of each? Answer.....Dols. 3 75cts.

16. The expense of erecting a certain bridge came to 1226 Dols. 25cts. which is to be defrayed equally by 45 persons; what must each one pay? Ans.....Dols. 27 25cts.

THE AMERICAN PRECEPTOR'S ASSISTANT.

17. Bought 5 chests of tea, weighing neat 504lb.
378 dollars; what was it a lb? Ans.....75 C

18. If the expense of a family be *Dols.* 638 75cts. annually, what is that a day? Answer.....*Dols.* 1 75c

19. A father left among his 5 sons an estate consisting of *Dols.* 9286 in cash, and 5 bills, each *Dols.* 117 68cts. He directed *Dols.* 80 to be laid out on his funeral, and his debts amounting to *Dols.* 438 60cts. to be paid; the remainder divided among them thus; the eldest to have $\frac{1}{3}$, and the other 4 equal shares; what is the share of each?

Answer..... { eldest son.....Dols.3118
 { others, each.....1559

20. If one-sixth of 124lb. 10oz. 18dw. 12gr. be disposed of, what is sold, and how much left?

lb. oz. dwt.
 Answer..... } sold 20 9 16
 } left 104 1 2

21. A footman would travel from Philadelphia to Savannah, reckoned 937 miles, in 32 days, what distance must he travel each day? Answer....29m. 2fur. 10

22. Twelve persons bought at auction 9 pieces of line each containing 25yds. 1qr. what was one person's eq share? Answer.....18yds. 3qrs. :

23. A farmer buys three adjacent tracts of land, containing 736A. 2R. 24per. 1000A. and 248A. 3R. 36per. which he would divide equally among six sons, what must each son have? Answer.....330A. 3R. 30per.

24. If 6 hogsheads of brandy, each containing 106 *gals.* 3 *qts.* 1 *pt.* be equally divided among 3 persons, what number of gallons has each? Answer.....213 *gals.* 3 *qts.* 1 *pt.*

25. Fifteen persons bought 247 bu. 2p. of wheat, 12s. 6d. the bushel; what is their equal share, and what must each one pay? (Bu. 16)

26. From the creation, to the year of our Lord 1800 are reckoned 5805 years; how many ages of three score years and 10, have elapsed since?

Answer.....Ages 82 + 65y

REDUCTION.

REDUCTION is the reducing of money, weights or measures, of a given denomination, to another, retaining the same value. Thus, $\text{£}.1 \times 20 \times 12 \times 4 = 960$ farthings. And 960 farthings, divided by 4, 12, and 20, continually = $\text{£}.1$.

RULE.

When great names are to be brought into less, multiply, taking into the product numbers of the next lower denomination: when less names are to be brought into greater, divide; and in either case, by as many of the less as make one of the next greater denomination.

Remainders bear the same name with their dividends.

To bring *cwt.s. &c.* to *lbs.*—Under the *lbs.* set the *lbs.* in the *qrs.* and the product of the *cwt.s.* by 12 under these; then place the units of the *cwt.s.* in the place of hundreds of the *lbs. &c.* the sum will be the *lbs.* Page 55, Ex. 5.

PROOF.

Reduction proves itself by reversing the operation.

REDUCTION OF MONEY.

1. To reduce silver and gold coin to equivalent value, in pounds Pennsylvania currency.

Dollars..... $\times 3 + 8$. Or, $\div 3 + \frac{1}{4}$ of the quotient.

French crowns.. $\times 4 \frac{1}{4} \div 10$.

French pistoles.. $\times 11 \div 8$.

Spanish ditto... $\times 7 \div 5$.

English guineas $\times 7 \div 4$.

French ditto.... $\times 8 \div 5 + \frac{1}{4}$ of the given number.

Moidores..... $\times 9 \div 4$.

Half johannes.. $\times 3$.

Federal eagles.. $\times 3 + \frac{1}{4}$ of the product.

Doubloons..... $\times 5 + \frac{1}{4}$ of the product.

2. To reduce pounds of the above currency, to silver and gold coin.

Dollars..... $\times 8 \div 3$. Or, $\times 2 + \frac{1}{4}$ of the product*.

French crowns $\times 2 + \frac{1}{4}$ product— $\frac{1}{4}$ the sum*.

* If the given sum be equal to a certain number of dollars, or crowns, these rules will apply; otherwise not.

2. 11933 half-pence, how many pounds?

Answer.....£.233 3 10½

3. In £.233 3 10½, how many half-pence?

Answer.....h. pence 11933.

4. Reduce £.160 15 6 to six-pences.

Facit.....six-pences 6431.

5. In 6431 six-pences, how many pounds?

Answer.....£.160 15 6.

6. In 11672 groats, how many pounds?

Answer.....£.194 10 8.

7. In 988 French crowns, how many groats?

Answer.....groats 24453

8. In 118800 groats, how many French crowns and dollars?

Answer.....
 { crowns, 4800
 { dollars, 5280

9. How many three-pences, groats, and six-pences, are in 1936 shillings?

Ans.....three-pences 7744, groats 3808, s. ps. 3872.

10. In £.1386, how many French crowns and dollars, and the number of each equal?

Answer.....1760.

11. Reduce 243 French pistoles to pounds, and these again to pistoles.

£.334 2 6.

12. Reduce 875 English guineas to pounds, and these again to guineas.

£.1531 5.

13. Reduce 320 moidores to pounds, and these again to moidores.

£.720.

14. Reduce 248 federal eagles to pounds, and these again to eagles.

£.930.

15. Reduce 124 doubloons to pounds, and these again to doubloons.

£.697 10.

16. Reduce dollars 2468 84 cents to crowns, and these again to dollars.

Crowns.....2244 40.

17. Reduce 10980 pence to cents, and these again to pence and dollars.

Cents.....} 1200.

Dolls.....} 122.

18. Reduce 4961 dollars to French crowns, these to pounds Pennsylvania currency, and these again to dollars.

Crowns.....510.

.....£.18667 6.

19. In 1220 English guineas, how many federal eagles.

Answer.....eagles 569 33½.

20. In 693 eagles, how many English guineas?

Answer.....guineas 1485.

21. In £.2077 4 8, how many French crowns, dollars, shillings and pence, the number of each to be equal?

Answer.....2468.

22. In 120 doubloons, how many pounds sterling; also, how much currency?

Answer..... { Sterling £.396.
Currency £.675.

23. What federal money is equal to 120 English guineas?

Answer.....Dollars 560.

24. What number of dollars is equivalent to 360 French pistoles?

Answer.....Dollars 1320.

25. In £.241 10, Pennsylvania currency, how many eagles?

Answer.....Eagles 64 4.

26. In 150 French guineas, how many cents? also how many pence?

Answer..... { Cents 69000.
Pence 62100.

REDUCTION OF WEIGHTS AND MEASURES.

1. How many ounces, pennyweights and grains, are in 148 lb? Answer.....1776 oz. 35520 dwt. 852480 gr.

2. In 852480 grains, how many lbs.?

Answer.....lbs. 148.

3. In 19 lb. 3 oz. of silver, how many dozen spoons, each 5 oz. 10 dwt.?

Answer.....Doz. 3 and 6.

4. How many dozen porringers, each to weigh 11 oz. will 154 lbs. of silver make?

Answer.....Doz. 14.

5. Reduce 28 cwt. 3 qrs. 24 lb. to pounds.

3 qrs. = 84 lb.

28 x 12 = 336

28

lbs. 3244 facit.

6. In 3244 lbs. how many cwt?

Answer.....28 cwt. 3 qr. 24 lb.

7. In 18 C. 10 lb. how many ounces and drams?

Answer.....oz. 32416, dr. 518656.

54 8. In 6 casks of flour, each 2ct. 2qrs. 11 lb. how many lbs. ? And divided equally between two persons, how much each ?

Answer..... { 1746.lbs.
each 7ct. 3qr. 5lb.

9. In 69ct. 24 lb. how many parcels, each 68 lbs. ?

Answer.....Parcels 114.

10. In 235 parcels of sugar, each 104 lbs. how many cwt ? Answer.....ct. 218 24lb.

Answer.....ct. 218 24lb.

11. In 266401 grains, apothecaries weight, how many lbs? Answer.....lbs.46 3 $\frac{3}{4}$. 1 gr.

Answer.....lbs.46 3 $\frac{3}{4}$. 1 gr.

12. In 20 parcels of drugs, each weighing 48 drams,
how many lbs. ? Answer.....lbs.10.

Answer.....lbs. 10.

13. Reduce 2 m. 1 fur. 8 p. 3 yds. 2 in. to inches.

Inches.....156334.

14. In 103783680 inches, how many miles?

Answer.....miles 1638.

15. Required the number of revolutions a wheel 18 f. 4 in. in circumference will make, in running 450 miles?

Answer.....rev.129600.

16. In 31 yds. 2 q. 2 n. how many nails ?

Answer.....nails 506.

17. How many ells English are in 2816 nails?

Answer.....ells 140 4 qrs.

18. In 10 bales of cloth, each 20 pieces, and each piece 24 yards, how many yards?

Answer.....yards 4800.

19. In 817 yds. 2 q. of cloth, how many ells Flemish, also how many ells English?

Answer..... $\left\{ \begin{array}{l} \text{cells F. } 1090. \\ \text{cells E. } 654. \end{array} \right.$

20. Reduce $54A$, $3R$, $24P$. to perches.

Per....., 8784.

21. In 17568 perches, how many acres?

Answer.....A.109 3R. 8P.

22. A tract of land, containing 1299600 square perches, is to be divided into 25 equal plantations; query the number of acres in each? Answer.....A.324 3 24.

Answer.....A.324 3 24.

23. In 7 pipes of wine, how many pints?

Answer.....Pts.7056.

24. Reduce 38304 pints to hogsheads.

Hhd:.....76.

25. Of gallon, quart, and pint bottles, each a like num-

ber, how many dozen must be taken, to draw off 3 casks of Madeira, each containing 165 gallons?

Answer.....30 dozen of each.

26. In 10108 pints, how many bushels?

Answer.....bush. 157 3 pecks 6 quarts.

27. In 4 granaries, each containing 65 bushels 1 peck 6 quarts, how many sacks will they fill, each to hold 5 bushels and an half?

Answer.....Sacks 47 bushels 3 peck 1 over.

28. Reduce 75 weeks 3 days to minutes.

Minutes.....760320.

29. In 49593600 seconds, how many weeks?

Answer.....weeks 82.

30. How many hours, minutes and seconds, are there in a year? Answer.....h.8766, m.525960, s.31557600.

31. From the creation of the world, 4004 years before Christ, to the year 1800 inclusive, how many minutes and seconds?

Answer..... $\left\{ \begin{array}{l} \text{min. } 3052671840. \\ \text{sec. } 183160310400. \end{array} \right.$

32. How many seconds are there in one complete revolution of any planet? Answer.....sec. 1296000.

PRACTICAL QUESTIONS.

1. How many nobles, each 6s. 8d. are there in £.993 6s. 8d.?

Answer.....nobles 2980.

2. In £.1986 13s. 4d. how many marks, each 13s. 4d.?

Answer.....marks 2980.

3. How many dollars are equal in value to 282 English guineas?

Answer.....dols.1316.

4. By what must £.13 14 7 be multiplied, to produce £.123 11 3?

Answer.....9.

5. If there be purses, containing 24 pieces each, of the several gold coins mentioned in page 21, what sum sterling do they contain? Also, how much Pennsylvania currency?

Answer.....£.330 12 sterl. £.555 cur.

6. Reduce 28800 pence to cents, to dollars, and to pounds Pennsylvania currency.

Facit..... $\left\{ \begin{array}{l} \text{Cents } 32000. \\ \text{Dols.} \dots 320. \\ \dots \dots \dots \text{£.120.} \end{array} \right.$

7. How many plates of 12 ounces each, may be made out of 8 ingots of silver, each 36 ounces?

Answer.....24.

8. What number of canisters, each to hold 38lb. may be filled from 14 chests of tea, each weighing 2ct. 1qr. 14lb?

Answer.....98.

9. How many parcels of 12lb. 16lb. 24lb. and 32lb. can a grocer have out of four casks of sugar, each weighing neat, 4ct. 3qr. 14lb?

Answer.....Parcels 26.

10. How many barley corns will reach round the globe of the earth, which is 360 degrees, and each degree 69 miles 4 furlongs?

Answer.....4755801600.

11. Imported from Rotterdam 46 bales of cloth, each containing 24 pieces, and each piece 82 ells Flemish; how many yards were therein? also, how many ells English?

Answer..... { Yards 67896.
E Eng. 54316 4q.

12. A manor containing 171000 acres of land, is to be divided into 456 equal plantations, required the number of acres in each?

Answer.....Acres 375.

13. Ten pipes of Canary wine are to be drawn off into an equal number of gallon, half-gallon, quart and pint bottles; the number necessary is required?

Answer..... 672 of each.

14. If before the birth of our Saviour were 4004 years, and since 1801; required the minutes in each of these periods; also, collected?

Answer.....Minutes { 2105943840 before.
947254320 since.
3053198160 coll.

THE SINGLE RULE OF THREE.

The Single Rule of Three is a rule for finding a fourth proportional to any three numbers, or terms given.

The first and second terms are a supposition, the third a demand : which third term may always be known, by its having respect to the questions, What cost ? how many ? how much ? And the middle term may be known, by its being of like kind, with the required answer.

The first and third terms must be of like kind, and (unless in contractions) reduced to the lowest denomination mentioned in either ; and the middle term, to its lowest given denomination.

This rule comprehends two kinds of proportion, direct and inverse.

DIRECT PROPORTION.

Direct proportion is, when more requires more ; or when less requires less : thus,

As 2 :: 4:8 to 16 ; more requiring more.

And, as 16 :: 8::4 to 2 ; less requiring less.

That is, If 2 yards cost 4s. 8 yards will cost 16s.

And, If 16s. will buy 8 yards, 4s. will buy 2 yards.

RULE.

The product of the second and third terms, divided by the first, will give the answer in the same denomination in which the middle term was left.

The operation may frequently be contracted, by using the aliquot parts of the dividing term, and those of one of the others ; or, by cancelling the dividing term with either of the others, or either of the others with the dividing term.

PROOF.

Invert the stating, placing the answer for the middle term, and work as the rule directs. Or,

When the price of an integer is given, the question may be wrought by compound multiplication.

EXAMPLES.

1. If 4 yards of linen cost £1 4s. what will 60 yards cost at that rate?

Yds. £. s. Yds.
If 4 .. 1 4 :: 60

29
—
24
60
—
4)1440
—
2,0)36,0
—

Ans.....£.18.

Yds. £. Yds.
If 60 .. 18 :: 4

4
—
£. s.
60)72 (1 4 proof.
60 —
—
12
20
—
60)240
240
—
0

Cancelled.

Yds. £. s. yds.
If 4 .. 1 4 :: 60

6
—
6 —
2,0)36,0
—

Answer.....£.18.

Yds. £. yds.
If 60 .. 3)18 :: 4

15
—
5)6
—
£.1 4 Proof.

2. If 1 gallon of wine cost 13s. 4d. what cost a cask containing 120 gallons? Answer.....£.80.

3. At 28s. per cwt. what is the value of 66 C. 3qrs. 16lb. of flour? Answer.....£.93 13.

4. If 36oz. 10dwts. of silver be worth £.9 2 6, what is that an ounce? Answer.....5s.

5. When a bankrupt compounds with his creditors, at 12s. 6d. in the pound, what is that creditor's quota, to whom he is indebted £.1000? Answer.....£.625.

6. What is tobacco a lb. when 17 C. 3qrs. 17lb. is sold for £.133 13 4? Answer.....1s. 4d.

7. What quantity of sugar will £.47 purchase, at £.2 13 4 the cwt? Answer.....C.17 2 14.

8. What do 518lb. of tea come to, if 90lb. cost £.36; and what is it a lb?

Ans.....£.207 4—at 8s. per lb.

9. If 17 tons 12C. of iron cost £.220, what is that for 2C. weight? Answer.....£.1 5.

10. If a man's daily income be 33s. 4d. what is that per annum? Answer.....£.608 6 8.

11. What comes 3 casks of brandy to, containing 58, 62, and $65\frac{1}{2}$ gallons, at 6s. 8d. per gallon? Answer.....£.61 16 8.

12. What will 4 pieces of cloth come to, containing 23, 24, 25 and 27 yards, at 21s. 8d. a yard? Ans....£.107 5.

13. A draper bought 242 yards of broad-cloth, for £.508 19 1, for 86 of which he gave 42s. 8d. a yard; what was the price a yard of the remainder? Answer.....41s 8 $\frac{1}{2}$ d.

14. What must be paid for 53 ells English and 1 qr. of Holland, at the rate of 7s. 9 $\frac{1}{2}$ d. a yard? Answer.....£.25 18 1 $\frac{1}{2}$.

15. An insolvent person pays £.840 12 6 $\frac{1}{2}$, for a debt of £.977; how much was that in the pound? Answer.....17s. 2 $\frac{1}{2}$ d.

16. A bankrupt compounds with his creditors for 8s. 7 $\frac{1}{2}$ d. per pound, and at that rate pays them £.420 6 3 $\frac{1}{4}$; how much was he indebted? Answer.....£.977.

17. What is 73lb. 5oz. 15dwts. of silver worth, at 5s. 9d. an oz? Answer.....£.253 10 0 $\frac{1}{2}$.

18. At the rate of 3s. 6d. in the pound, what is the tax on £.1527 10? Answer.....£.267 6 3.

19. What will 1qr. 1na. of velvet cost, at 18s. 6d. a yard? Answer.....5s. 9 $\frac{1}{2}$ d. +

20. At 6s. 4d. an ounce, what is the tankard worth that weighs 19oz. 14dwts? Answer.....£.6 4 9. +

21. What must be paid for 7 casks of prunes, each weighing 4C. 3qrs. at 59s. 8d. per C. weight? Answer.....£.99 3 11.

22. At £.2 15 4 per acre, what is the value of 173A. 2R. 14perches? Answer.....£.480 5 2. +

23. If 5 yards of cloth cost 28s. 7d. what is the value of 18 pieces, each containing 21 yds. 1 qr. and what is it a yard? Answer..... { £.108 7 6.
per yd. 5 8.

24. If a man's annual income be £.1000, and his daily expense 19s. 11d. what does he save at the year's end? Answer.....£.636 10 5.

25. If a staff, 4 feet long, cast a shade on level ground 7 feet; what is the height of a steeple, whose shade at the same time measures 198 yards?

Answer.....feet 339 $\frac{1}{2}$.

26. A merchant would lay out in spices £.280, viz. cloves at 4s. a lb. mace at 7s. cinnamon at 3s. and all-spice at 2s. and would have an equal quantity of each; query the quantity?

Answer.....of each 350lb.

27. A goldsmith bought 7lb. 1oz. 14dwts. of gold, for £.257 2; what was that an ounce? Ans.....£.3.

28. How many reams of paper, at 12s. 6d. 14s. 9d. and 17s. 4d. per ream, and of each an equal number, may be purchased with £.396 15 10? Ans....178R. of each.

29. What is the value of 5 bales of cloth, each bale containing 24 pieces, and each piece 21 Flemish ells, at 19s. 1 $\frac{1}{2}$ d. the ell English? Answer.....£.1445 17.

30. Sold 59C. 1qr. 14lb. of sugar, at 60s. 8d. per C. weight; what was the amount; also, what was it by the lb?

Answer..... { amount £.180 2 1.
per lb. 6 $\frac{1}{2}$ d.

31. Sold a tract of land, containing 953Ac. 3R. 16P. at £.6 15 10 the acre; what was its value?

Answer.....£.6478 4 7 $\frac{1}{2}$.

32. Bought a cask of sugar, weighing neat-504lb. at 8 $\frac{1}{2}$ d. a lb. which being sold at 9 $\frac{1}{2}$ d. what was gained thereby?

Answer.....£.1 11 6.

33. What is the value of 1 C. weight of sugar, at 16 cents a lb?

Answer.....Dols.17 92cts.

34. Sold 6 C. weight of tobacco, at 10cts. a lb. what is the value in dollars; also in Pennsylvania currency?

Answer..... { Dols.67 20cts.
£.25 4.

35. Bought 12 pieces of cloth, each 24 yards, at Dols.4 20cts. a yard; what is the amount in Pennsylvania currency?

Answer.....£.453 12.

36. Bought 4 pieces of linen, two of which contained 26 $\frac{1}{2}$ yards each, and each of the others 23 $\frac{1}{2}$ yards; what did they come to at 76cts. per yard?

Answer.....Dols.76 38cts.

37. Bought 3 casks of raisins, each weighing 3C. 1qr. 7lb. neat; what is their value, at Dols.6 20cts. per C. weight?

Answer.....Dols.61 61cts.

38. If a gentleman's income be £.2108 5 7½ a year, how many dollars may he expend daily, and save £.500 annually? Answer.....Dols.11 75cts.

39. At Dols.3 50cts. an ell English, what is the value of 40 pieces of cloth, each containing 42 Flemish ells?

Answer.....Dols.3528.

40. Bought 5 pipes of wine, at 12s. 6d. the gallon, which being sold at 13s. 9d. the gain of that purchase and sale is required in Federal money; also, the prime cost, and amount of the sale?

Answer..... { gain, 105 Dols.
prime cost, 1050 Dols.
sold for, 1155 Dols.

INVERSE PROPORTION.

INVERSE Proportion is, when more requires less; or, when less requires more: thus;

Da. hrs. Da. hrs.

As 4 : 18 :: 6 to 12 ; more requiring less.

qrs. yds. qrs. yds.

And, as 5 : 15 :: 3 to 25 ; less requiring more.

That is, 6 days of 12 hours = 4 days of 18 hours.

And 25yds. of 3qrs. wide = 15yds. of 5 qrs. wide.

RULE.

The product of the first and second terms, divided by the third, will give the answer in the same denomination in which the middle term was left.

Cancelling applies in this rule, as in direct proportion.

PROOF.

Invert the stating, placing the answer for the middle term, and work as the rule directs.

EXAMPLES.

1. If 48 men can build a wall in 24 days; how many men can do it in 192 days?

$$\begin{array}{r} \text{D. M. D.} \\ \text{As } 24 : 48 :: 192 \\ \hline 24 \end{array}$$

$$\begin{array}{r} 192 \\ 96 \\ \hline \text{---M.} \\ 192)1152(6\text{---Answer.} \\ 1152 \\ \hline 0 \\ \hline \end{array}$$

$$\begin{array}{r} \text{D. M. D.} \\ \text{As } 192 \dots 6 :: 24 \\ \hline 6 \end{array}$$

$$\begin{array}{r} \text{---M.} \\ 24)1152(48\text{---proof.} \\ 96 \\ \hline 192 \\ 192 \\ \hline 0 \\ \hline \end{array}$$

Cancelled.

$$\begin{array}{r} \text{D. M. D.} \\ \text{If } 24 \dots 48 :: 192 \\ \hline \end{array}$$

Answer..... 6 men. ∇

2. What quantity of shalloon of 3 qrs. wide, will line 7yds. 2qrs. of cloth, that is 6qrs. wide?

Answer.....yds.15.

3. If 200 men can finish a piece of work in 12 days, how many are sufficient to do it in 3 days?

Answer.....men 800.

4. How much in length, that is 4 inches broad, will make a superficial foot?

Answer.....feet 3.

5. How many yards of carpeting, that is 3 qrs. wide, are sufficient to cover a room that is 18 feet wide, and 60 in length?

Answer.....yards 160.

6. If £.100 principal in 12 months gain £.6 interest; what principal will gain the same in 8 months?

Answer.....£.150

7. How many yards of paper, 5 qrs. wide, will be sufficient to cover a room that measures 20 yards round, and 4 in height?

Answer.....yards 64.

8. If a journey be performed in 6 days, when the days are 12 hours long; how many days of 16 hours long, will be necessary to go the same journey?

Answer.....days 8.

9. How much in length, that is 8 poles in breadth, will contain an acre?

Answer.....poles 20

10. A. lent B. £.100 for 6 months; how long ought B. to lend A. £.375, that the interest may be equivalent? Answer..... year 1 4 months.

11. If when the price of a bushel of wheat is 4s. 6d. the half dime loaf weighs 12 oz. what ought the loaf to weigh, when wheat is at 3s. the bushel?

Answer..... oz. 18.

12. What is the weight of a pea to a steelyard, which, being suspended 39 inches from the centre of motion, will equipoise 208 lb. suspended at the draught end 3 quarters of an inch? Answer.....lbs. 4.

13. A piece of ground is 16 perches wide; of what length must it be, to contain 5 acres?

Answer.....perches 50.

14. In what time will £.175 gain £.126 interest, when £.700 will gain it in 3 years? Answer.....years 12.

15. Of what width must a lot of ground be to contain an acre, when it is $13\frac{1}{2}$ poles in length?

Answer.....poles 11 4 yds. 2 feet 2 b. c.

16. If wheat is at 1 dollar 66 cents a bushel, the cent loaf weighs 9 oz.; what ought it to weigh, when wheat is at 1 dollar 24 cents 5 mills? Answer.....oz. 12.

17. A. lent B. 2500 dollars for three years; how long ought B. to lend him 3000 dollars, that the interest of it may equal that of A's. money?

Answer.....2 years 6 months.

PRACTICAL QUESTIONS.

1. If 3 qrs. of a yard of velvet cost 7s 8d. what number of yards may be purchased for £.27 11?

Answer.....yards 57.

2. At 13s. $2\frac{1}{2}$ d. per yard, what is the value of a piece of cloth, containing 52 ells English and 3 qrs. of a yard?

Answer.....£.43 8 $5\frac{1}{4}$ +

3. If the carriage of 5 Cwt. 14 lb. for 96 miles cost 32s. 6. how far may 3Cwt. 1qr. be carried for the same money? Answer.....miles 151 3 f. 3 poles. +

4. Bought 200 yards of cambrick, for £.90, which being damaged, the loss of 20 dollars is to be sustained in the whole; at what rate per ell English must it be sold so as neither to gain nor lose?

Answer..... 10s. 3 $\frac{3}{4}$ d.

5. A certain steeple projected upon level ground a shadow to the distance of 633 feet 4 inches, when a staff 3 feet in length, perpendicularly erected, cast a shade of 6 feet 4 inches; the height of the steeple is required?

Answer.....yards 100.

6. Of what length must a board be, that is $7\frac{1}{2}$ inches in width, to measure 30 square feet?

Answer.....feet 32.

7. If in an hour, 50 gallons of water fall into a cistern, which holds 230 gallons, and by a pipe, it discharges 35 gallons in the same space of time; in what time will it be filled?

Answer.....hours 15 20 minutes.

8. If 117oz. 12dwt. of gold be worth dollars 1097 60 cents, what is that per pennyweight?

Answer.....cents 46 6 mills. +

9. The rent of a certain estate amounts to £.1750, on which is assessed £.65 12 6; what is that in the pound, federal money?

Answer.....cents 10.

10. Bought 3 tons of oil for £,226 9 3; 85 gallons of which leaking out, the remainder is to be disposed of to sustain no loss: the price of a gallon in federal money is required?

Answer.....cents 90.

THE DOUBLE RULE OF THREE.

THE Double Rule of Three is that, wherein five numbers, or terms are given, to find a sixth proportional to the third.

To state questions in this rule:

Place the two terms of the supposition, one under the other; that of the same name with the answer sought, in the second place, and the demanding terms, each opposite to that of a similar denomination in the supposition, in the third. Then, consider each of the extremes, and the middle term, as two distinct statings in the single rule of three. If both of these be direct, the question is direct; but if either of them be inverse, the question will be inverse.

DIRECT PROPORTION.

RULE.

The product of the two last extremes, with the middle term, divided by the product of the two first, will give the answer.

The method of abbreviating, or cancelling, is applicable in this rule, as in the single rule of three.

PROOF.

By two statings of the single rule of three ; or, reverse the question.

EXAMPLES.

1. If 4 men in 12 days, reap 36 acres ; how many acres can 8 men reap in 16 days ?

If 4 men } 36 acrs. { 8 men M. A. M. D. A. D.
12 days } 16 days If 4 :: 36 :: 8 If 12 :: 72 :: 16

—	—	8	16
48	128	—	—
—	36	4)288	12)1152

—	—	—
768	Acrs. 72	Acrs. 96 prf.
384		

—	Acres.	Cancelled.
48)4608	(96 Answer. If	4} 36 { 8
432		12} 56 { 16
—		3 12 4
288		8
288		—
—		96 Acres.
0		—

2. If 10 bushels of oats be sufficient for 18 horses 20 days ; how many bushels will serve 60 horses 36 days ?

Answer.....bushels 60.

3. If 56lb. of bread be sufficient for 7 men 14 days ; how many lb. will suffice 21 men 3 days ?

Answer.....lb. 36.

4. If 4 men have £.3 4 for four days work; how much ought 24 men to receive for 16 days?

Answer.....£.76 16..

5. If £.350 in half a year, raise £.10 10 interest; what will be the interest of £.400, for 4 years?

Answer.....£.96.

6. What is the interest of £.519 6 10 for 40 weeks, at 5 per cent?

Answer.....£.19 19 5 $\frac{1}{4}$ +

7. If 45 dollars 10 cents be the wages of 16 men for 8 days; what will 8 men earn in 24 days?

Answer.....dollars67 65 cents.

8. If 200 dollars in 9 months amount to 209 dollars; at what rate per cent is the interest computed?

Answer.....6 per cent.

9. If the carriage of 8C. weight 128 miles cost 12 dollars 80 cents; what must be paid for the carriage of 4 C. weight 32 miles?

Answer.....dollar 1 60 cents.

INVERSE PROPORTION.

RULE.

Transpose the extremes of the inverse term, and work as in direct proportion.

PROOF.

As in direct proportion.

EXAMPLES.

1. If 4 men have 48s. for 3 days work, how many men will earn £.9 12 in 16 days?

If 48s. } 4M. { 192s.
3D. } { 16D. inverse.
16 3

768

576

4

768)2304(3 men....Answer.

2304

0.

S. M. S.
If 48 .. 4 :: 192

D. M. D.
As 3 .. 16 :: 16 inverse.

4
—
48)768(16 M.
48
—
288
288
—
0

3
—
16)48(3 M.....proof.
48
—
0

Cancelled.

If $\frac{48}{3} \} 4 \{ \frac{192}{16}$
 $\frac{16}{3}$ 3 men.

2. If, when the days are 14 hours long, a footman can travel 420 miles in 16 days; in how many days of 12 hours long, can he travel 1260 miles?

Answer.....days 56.

3. If £.100 will defray the expense of 10 men for 22 weeks and 6 days; how long will £.300 serve 24 men?

Answer.....weeks 28 4 days.

4. If 16 dollars be the wages of 8 men for 3 days; how long must 20 men work for 160 dollars?

Answer.....days 12.

5. If 100 dollars in 12 months gain 8 dollars interest; what principal will gain £.17. 4 in 10 months?

Answer.....688dols.

PRACTICAL QUESTIONS.

1. How many men must be employed to reap 480 acres in 12 days, if 36 men can reap 120 acres in 5 days?

Answer.....men 60.

2. If 5 men make 150 pair of shoes in 20 days; how many men may make 1350 pair in 60 days?

Answer.....men 15.

3. A farmer having sown 48 bushels of wheat, found the increase to be 1152 bushels; now supposing he sows 120 bushels successively for 6 years, what will be his

whole increase at the expiration of the last year? and what the increase per bushel?

Answer..... { increase, 17280.
the bushel, 24.

4. If £.172 principal in 8 months amount to £.177 14 8; at what rate per cent. was interest computed?

Answer.....£.5 per cent.

5. What is the interest due on a bond for £.176 15 9, at the end of 9 years, at 5 per cent. per annum?

Answer.....£.79 10 2½.

6. If the carriage of 6 C. weight 150 miles cost 11 D. 20 cts. what must be paid for the conveyance of 15 C. 1qr. 100 miles?

Answer.....dols.18 97cts. +

7. If 100 dollars in a year gain 7 dols. interest; what sum will gain 77 dols. in 15 months?

Answer.....880dols.

PRACTICE.

PRACTICE is a rule for finding the value of any commodity, at the given price of an integer.

TABLES.

gr.	d.	of a penny.	s. d.	of a pound.	7lb.	of an C. weight.	of a Ton.
1	1	1	0	1	8	1	1
2	2	2	8	2	14	2	2
			0	3	16	3	3
d.			6	4	28	4	4
1	1	1	4	5	56	5	5
1½			0	6	1 C.	6	6
2			0	7	2	7	7
3			8	8	3	8	8
4			0	9	5	9	9
6			0	10	10	10	10

CASE 1.

When the price of an integer is the aliquot part of a penny, shilling or pound;

RULE.

Take such aliquot part of the given quantity, as the

price is of a penny, shilling, or pound, for the answer in pence, shillings, or pounds, respectively.

PROOF.

Vary the parts; or, work by compound multiplication; or, by the single rule of three direct.

For the pupil to be thus frequently exercised, will be a profitable amusement.

EXAMPLES.

$\begin{array}{r|l} \frac{1}{4} & 4800 \text{ lbs. at } \frac{1}{4} \text{ per lb.} \\ \hline 12 & 1200 \\ \hline 2,0 & 10,0 \\ \hline \end{array}$ <p style="text-align: center;"><u>£.5 facit.</u></p>	$\begin{array}{r|l} 1\frac{1}{2} \text{ d.} & 3640 \text{ lbs. at } 1\frac{1}{2} \text{ p. lb.} \\ \hline 2,0 & 45,5 \\ \hline \end{array}$ <p style="text-align: center;"><u>£.22 15 facit.</u></p>
--	--

$$\begin{array}{r} 0 \frac{1}{4} \text{ d.} \\ 10 \\ \hline 2 \frac{1}{2} \\ 10 \\ \hline 21 \\ 4 \\ \hline 84 \\ 12 \\ \hline \end{array}$$

$$\begin{array}{r} \text{If } 1 - 1\frac{1}{2} \text{ d.} - 3640 \\ 2 \quad 3 \\ \hline 3 \quad 2)10920 \\ \hline 12)5460 \\ \hline 2,0)45,5 \\ \hline \end{array}$$

£.22 15 prf.

£.5 0 0 proof.

			£.	s.	d.
3.	9876 lbs. at $\frac{1}{4}$ d. per lb.	}	Facit.....		
4.	4938 $\frac{1}{2}$		10	5	9
5.	10170 galls. at 2d. per gall.				
6.	6780 3		84	15	0
7.	5085 4				
8.	3390 6	}	593	16	8
9.	7150 yards at 1s 8d. per yard.		246	16	0
10.	2468 2		71	2	6
11.	5690 2 6		11	10	0
12.	69 3 4		159	6	8
13.	478 6 8	}	493	10	0
14.	956 3 4				
15.	987 10 0				

CASE 2.

When the price of an integer is not the aliquot part of a penny, shilling, or pound;

RULE.

Take the nearest part, and for the rest, parts of parts. If it be shillings only, multiply by them, and divide the product by 20. Or,

If the shillings be even, multiply by half the number, doubling the product of the unit figure for shillings, the rest of the product will be pounds. Or,

When the complement to the price of a penny, shilling, or pound, is an aliquot part; take such part from the given quantity, and the remainder will be the answer in pence, shillings, or pounds respectively.

$\frac{3}{4}$ $\frac{1}{2}$ 3292lb. at $\frac{3}{4}$ d. per lb. d.

$$\begin{array}{r} \frac{3}{4} \quad \frac{1}{2} \\ \hline 1646 \\ 823 \\ \hline 12 \quad 2469 \\ \hline 2,0 \quad 20,5 \quad 9 \end{array}$$

£.10 5 9 facit.

$\frac{3}{4}$ $\frac{1}{4}$ 7000lb. at $3\frac{1}{4}$ d. per lb.

$$\begin{array}{r} \frac{3}{4} \quad \frac{1}{4} \\ \hline 1750 \\ 437 \quad 6 \\ \hline 2,0 \quad 218,7 \quad 6 \end{array}$$

£.109 7 6 facit.

$\frac{3}{4}$ $\frac{1}{4}$ 3292 complem. $\frac{1}{4}$ d.
823 subtract.

$$\begin{array}{r} 12 \quad 2469 \\ \hline 2,0 \quad 20,5 \quad 9 \end{array}$$

£.10 5 9 proof.

If 1lb. $3\frac{1}{4}$ d. 7000lb.
4

$$\begin{array}{r} 15 \\ 7000 \end{array}$$

$$4)105000$$

$$12)26250$$

$$2,0)218,7 \quad 6$$

£.109 7 6 proof.

			£.	s.	d.
3.	2710 galls, at $2\frac{1}{2}$ d. per gall.	} Facit.....	28	4	7
4.	1355				
5.	2056		36	8	2
6.	2708		76	3	3
7.	3271 yards, at 7d. per yard		95	8	1
8.	2759		97	14	$3\frac{1}{2}$
9.	2150		87	6	$10\frac{1}{2}$
10.	6825		263	10	10
11.	729 lbs. at $10\frac{1}{4}$ per lb.		326	11	$6\frac{1}{4}$
12.	3256		149	4	8
13.	3764		179	17	7
14.	2714 galls. at $5\frac{1}{2}$ per gallon	} Facit.....	59	7	$4\frac{1}{2}$
15.	1357				
16.	9480				
17.	4740		148	2	6
18.	3160				
19.	2790 yards, at 1s. $1\frac{1}{2}$ d. per yard.		156	18	9
20.	3270		221	8	$1\frac{1}{2}$
21.	2104		188	9	8
22.	5000		479	3	4
23.	4000		395	16	8
24.	1234 bushels at 3 0 per bushel.	} Facit.....	185	2	0
25.	617				
26.	9876		2801	10	6
27.	4274				
28.	2137		1602	15	0
29.	2468				
30.	1234		1228	17	2

CASE 2.

When the price of an integer is pounds, shillings, &c.

RULE.

Multiply by the pounds, and for the rest, proceed as before.

EXAMPLES.

	£. s. d.	Yd.	£. s. d.
2107 yds. at 2 s. 8 per yd.		If 1..2 8::2107	
2	—	20	48
—	4	—	—
4214		48	16856
842 16		—	8428
—		—	—
£.5056 16 Facit		2,0)10113,6	
—		—	—
		£.5056 16 Pr.	

2.	7156 C. wt. at	£.5 6 per Ct. Facit	£.37926 16 0
3.	3215	4 6 8	13931 13 4
4.	2071	2 3 4	5852 3 4
5.	2157	3 15 2½	8108 19 5½
6.	4300 tons at	8 18 0½	} 38283 8 0
7.	1075	35 12 3	
8.	2214	2 3 3½	} 4794 13 10½
9.	738	6 9 11½	
10.	246	19 9 9½	

CASE 4.

When the given quantity, and price also, are of several denominations;

RULE.

Multiply the price by the integers, and take parts for the rest. Or,

Multiply the integers of the quantity by the integers of the price; then, take parts of the integers for the rest of the price, and parts of the price for the rest of the quantity.

EXAMPLES.

Ct.	qr.	lb.	£.	s.	d.	s. d.	Ct.	qr.	lb.
342	2	14	at	3	6	8	per Cts	5	8
			£.	s.	d.	2 qr.			
			3	6	8	$\times 2$			
					10				
			33	6	8	$\times 4$			
					10				
			333	6	8				
					3				
			1000	0	0				
			133	6	8				
			6	13	4				
14 lb	$\frac{1}{4}$		1	13	4				
				8	4				
			£.1142	1	8	Facit.			

Ct.	qr.	lb.	£.	s.	d.	Facit.	£.	s.	d.				
2.	66	3	16	at	2	16	per Ct.	£.187	6	0			
3.	35	3	10		4	5		152	6	3½			
4.	145	3	26		8	11	5	1251	3	8¼			
5.	17	Tons	12	ct.	iron,	at	£.12	10	per ton	220	0	0	
6.	185	Galls.	2	qts.	molasses	at	6	8	per gall.	61	16	8	
7.	100½	Yards	linen		at		5	4	per yd.	26	16	0	
8.	419½	Yards	cloth		at		37	6	}	787	0	7½	
9.	839½						18	9					
10.	476	Acres	3r.	28	p.	at	3	7	11	}	1619	11	1½
11.	953		3	16			1	13	11½				
12.	2	qrs.	14	lb.		at	3	7	6	per ct.	2	2	2½
13.			24	lb.		at	4	17	0		1	0	9¼
14.	3	qrs.	2	nails	velvet	at	17	6	per yd.	0	15	3½	
15.	72	lb.	5oz.	15	dwt.	of silver	at	5	9	per oz.	253	10	0¼

CASE 5.

When the price of an integer is in Federal money;

RULE.

Multiply the integers by the price, and separate two fi-

figures to the right for cents, if there be cents, and three, if there be mills; the figures on the left will be dollars. Or, multiply by the dollars, and take parts for the cents, &c.

EXAMPLES.

428 yards, at 2 dollars $32\frac{1}{2}$ cents per yard.

428	25	$\frac{1}{2}$	428
2 $32\frac{1}{2}$			3
<hr/>			<hr/>
856			856
1284	5	$\frac{1}{2}$	107
856	$2\frac{1}{2}$	$\frac{1}{2}$	21 40
214			10 70
<hr/>			<hr/>

Dolls. 995 10 facit.

Dolls. 995 10 proof.

				D. C.
2.	762 lbs. at 12 cts. per lb.	Facit.....	91	44
3.	976 43		419	68
4.	1025 galls. at 1 Dol. 75 cts. per gall.		1793	75
5.	987 2 82		2783	34
6.	1234 1 $75\frac{1}{2}$		2165	67
7.	4068 yds. at 3. $28\frac{1}{2}$ per yard.		13363	38
8.	8274 1 $15\frac{1}{2}$		9556	47
9.	5684 2 $79\frac{1}{2}$		15872	57
10.	4464 3 $47\frac{1}{2}$	}		
11.	2232 6 $94\frac{1}{2}$		15501	24
12.	1438 10 $41\frac{1}{2}$			

PRACTICAL QUESTIONS.

- At 3 farthings per yard, what is the value of 4712 yards?
Answer.....£.14 14 6.
- Sold 6789 yards of tape, at $1\frac{1}{4}$ d. a yard; what came it to?
Answer.....£.49 10 0 $\frac{1}{4}$.
- Bought 1002 lb. of sugar, at $10\frac{1}{4}$ d. per lb. what was its value;
Answer.....£.43 16 9.
- At 1s. $11\frac{1}{4}$ d. the lb. what will 2468 lb. of loaf sugar come to?
Answer.....£.244 4 7.
- At 6s. 8. per bushel, what is the value of 138 bushels of potatoes?
Answer.....£.46.

6. Wine at 11s. a gallon, what is the value of 543 gallons?
Answer.....£.298 13.

7. At 13s. 4d. per bushel, what will 800 bushels of wheat amount to?
Answer.....£.533 6 8.

8. Sold 1750 bushels of wheat, at 12s. 9½d. a bushel; what does it come to?
Answer.....£.1119 5 5.

9. At £.6 6 8 a ton, what will 47 tons of hay amount to?
Answer.....£.297 13 4.

10. Sold 16ct. 2qr. 17lb. of sugar, at £.5 11 10 per cwt, what is its value?
Answer.....£.93 2 2¼.

11. Rice, at £.3 17 6 per cwt. what is the value of 144cwt. 2qr. 21lb.?
Answer.....£.560 13 3¼.

12. A pair of silver buckles, weight 50 dwt. 20 gr. what is their value, at 17s. 6d. per oz.?
Answer.....£.274 5 3.

13. Hay sold at £.8 7 6 per ton, what will 185T. 17C. 2qrs. amount to?
Answer.....£.1556 14 0¼.

14. Land rated at £45 17 6 an acre, what is the value of a plantation, that contains 1157 acres 2 roods?
Answer.....£.5300 6 3.

15. Bought a tract of land, containing 578 acres 3 roods, at £.11 15 an acre; what was its value?
Answer.....£.6800 6 3.

16. At 39s. 4d. an ell, what is the value of 1677 ells of cloth?
Answer.....£.3298 2.

17. Sold 83yds. 2qrs. of superfine scarlet cloth, at 10 dollars 50 cents per yard; query the amount?
Answer.....876dolls. 75cts.

18. Bought at auction 6708 ells of fine linen, at 1doll. 32cts. an ell; what is the amount of the auctioneer's bill?
Answer.....8854dolls. 56cts.

19. Sold 346yds. 3qrs. of velvet, at 2 dolls. 25 cts. a yard; what was its value?
Answer.....780 dolls. 18 cts. +

20. What is the value of 30T. 18Cwt. of iron, at 55 dollars 50 cts. per ton?
Answer.....1714 dolls. 95 cts.

TARE AND TRETT.

TARE and **Trett** is a rule for finding the neat weight of such goods as are subject to a deduction on account of what they are contained in, and for waste, &c.

Gross weight is the weight of the whole collectively.

Tare is the weight of whatever contains the goods; which is either so much in the whole, so much per barrel, &c. or so much per C. weight.

Trett is an allowance of 4 lb. in every 104, for waste, &c.

Neat is the weight of the goods, after all deductions are made.

When there is an allowance of trett, after the tare is taken from the gross, the remainder is called **suttle**.

CASE 1.

When the tare is so much in the whole quantity ;

RULE.

Take the tare from the gross, and the remainder will be the neat.

EXAMPLES.

1. Sold 456 C. 1 qr. 19 lb. of sugar, tare in the whole 15 C. 2 qrs. 13 lb. what is the neat weight; and what does it amount to, at £.3 11 4 per C.?

	C.	qr.	lb.	gr.	£.	s.	d.
Gross	456	1	19		3	11	4
Tare	15	2	13	2 $\frac{1}{2}$			

$$4 \times 11 \times 10 = 440$$

Cwt. 440 3 6

14 5 4

11

156 18 8

10

1569 6 8

1 $\frac{1}{2}$ 1 15 8

4lb. $\frac{1}{7}$ 17 10

2 $\frac{1}{2}$ 2 6 $\frac{1}{2}$

1 3 $\frac{1}{4}$

£.1572 3 11 $\frac{1}{4}$ Amount

2. Bought 12 hhds. of tobacco, weighing gross 100 C. 3 qrs. 20 lb. tare in the whole quantity 1570 lb. required the neat weight, and its value, at 55s. per Cwt?

Answer..... } Neat, 86C. 3qrs. 18lb.
 } Value, £.239 0 1.

3. What is the neat weight of 38 hhds of sugar, weighing gross 201 C. 3 qrs. 12 lb. tare in the whole 2355 lb. and at £.10 6 8 per C. weight, what is its value in federal money, and what a lb?

Answer..... } Neat, 180 C. 3qrs. 9 lb.
 } value, 3150 dolls. 46cts. +
 } a lb. 15 cts. 5m. +

CASE 2.

When the tare is so much for each article which contains the goods ;

RULE.

Subtract the tare of a single article from its gross, and multiply the remainder by the number of articles for the neat. Or,

Multiply the tare by the number of articles, and take the product from the gross.

EXAMPLES.

1. Sold 30 hhds. of sugar, each weighing gross 7 C. 3 qrs. 25 lb. tare per hhd. 30 lb. required the neat weight and its value, at £.6 12 6 per C. weight?

C. qr. lb.

lb. 7 3 25

30=0 1 2

£. s. d.
16lb= $\frac{1}{7}$)6 12 6
 $3 \times 7 \times 11 = 231$

7 2 23
3X10=30

23 0 13
10

C. 231. 0 18 Neat.

$$\begin{array}{r} 1530 \quad 7 \quad 6 \\ 2 \quad \frac{1}{2}) \quad 18 \quad 11 \\ \quad \quad 2 \quad 4 \frac{1}{2} \end{array}$$

£.1531 .8 9½ Value.

2. What is the neat weight and value of 8 hhds. of tobacco, gross 86 C. 2 qrs. 24 lb. tare 100 lb. per hhd. the neat at £.3 14 8² And what is it per lb.?

Answer:..... { Neat, 79 C. 2 qrs. 8 lb.
value, £.297 1 4.
per lb. 8d.

3. Bought 24 kegs of raisins, each gross 50 lb. tare 8 lb. per keg, at 20 dollars per C. weight neat; what was the neat weight and prime cost? And, retailed at 20 cents the lb. what was the gain?

Answer:..... { Neat, 9 C. weight.
prime cost. 180 dolls.
gain, 21 dolls. 60 cts.

CASE 3.

When the tare is at so much in the C. weight;

RULE.

Divide the given quantity by such aliquot part, as the tare is of an C. weight; the quotient subtracted from the gross leaves the neat. Or,

The lbs. of the gross, multiplied by the tare per C. wt. and the product divided by 112, gives the lbs. tare.

EXAMPLES.

1. In 12 casks of prunes, each 8 C. 2 qrs. 14 lb. tare per C. weight 16 lbs. how much neat weight; and what does it come to at £.4 13 4 per C. wt.?

C. qrs. lbs.			qrs. £. s. d.			
8	2	14	2	½	4	13 4
		12	16 lb.	½		8
16 lbs. ½			37 6 8			
103 2 0 Grs.			11			
-14 3 4 Tare.						
C. wt. 88 2 24 Neat.			410 13 4			
			2 6 8			
			8 ½			
			13 4			
			6 8			
			£.414 0 0 Am't.			

2. What is the neat weight and value of 40 kegs of figs, gross 75 Cwt. 3qr. 14 lb. tare per Cwt. 14 lb. at 37s. 4d. per Cwt.? and what will 12 lb come to at that rate?

Answer..... { Neat 66Cwt. 1qr. 16lb.
Value £.123 18.8.
Value of 12lb. 4s.

3. Bought 43Cwt. 3qr. 21lb. gross of sugar, tare 12lb. per Cwt. required the neat weight, and its value, at 13 dollars 71 cents per Cwt. and the price a lb.?

Answer,..... { Neat 39Cwt. 27lb.
Value 537 dolls.99cts. +
A lb. 12 cents 2m. +

CASE 4.

When there is an allowance of trett.

RULE.

Divide the lbs.uttle by 26; the quotient subtracted from the suttls, leaves the neat.

EXAMPLE.

1. A merchant bought 50 bags of coffee, each gross 2Cwt. 1qr. 14 lb.; tare per bag 5lb. trett 4 lb. per 104 lb.; he gave 22 dollars 40 cents per Cwt. neat, and disposed of it at 25 cents per lb. the neat is required, and the gain of that purchase and sale?

Cwt. qr. lb.

$$2 \ 1 \ 24 = 276 \times 50 = 13800 \text{ lbs. gross.}$$

$$13800 \times .15 \div 112 = 616 \text{ tare.}$$

$$\begin{array}{r} 13184 \text{ suttls.} \\ 13184 \div 26 = 507 \text{ trett,} \end{array}$$

$$\text{Lbs. neat } 12677 = 113 \text{ Cwt. } 21 \text{ lb.}$$

Cwt. lb. dolls. cts.

$$113 \ 21 \text{ at } 22 \ 40 = 2535 \ 40 \text{ prime cost.}$$

$$12677 \text{ lb. at } 25 \text{ cts.} = 3169 \ 25 \text{ sold for.}$$

$$\text{Dollars } 633 \ 85 \text{ gain,}$$

2. Bought 17Cwt. 3qr. 12 lb. of grocery, tare is the

whole 76lb. trett 4 per 104lb.; how many lb. neat, and what do they amount to, at 20 cents a lb.?

Answer..... { Neat 1850lb.
 { Amt. 370 dolls.

3. Sold 88Cwt. 2qr. 11lb. gross, tare 6lb. per Cwt. trett 4lb. per 104; the neat weight is required, and its value at 9 dollars 67 cents per C. weight?

Answer..... { Neat 80Cwt. 2qr. 15lb.
 { Value 779dolls. 72cts. +

INTEREST.

INTEREST is a compensation for the use of money, at a certain rate per-cent per annum; and is either **Simple** or **Compound**.

There are three things relative to the calculating of interest, viz.

The Principal, which is the sum lent.

The Time; and,

The Rate per cent, which is the interest of £.100 for one year.

By these, the interest of any sum is found; the result of which, added to the principal, will give the amount.

SIMPLE INTEREST.

Simple interest is that which annually arises from a given principal.

CASE 1.

When the time is years, and the rate per cent pounds; or $\frac{1}{2}$, $\frac{1}{3}$, or $\frac{1}{4}$ more than the pounds given;

RULE.

1. The product of the principal by the rate, divided by 100, will be the interest for one year; which, multiply by the years given. Or, —

2. At 5 per cent. the interest is just as many shillings

as the pounds given; which divide by 20: then, if the rate be 6, to the interest at 5, add $\frac{1}{2}$ thereof; if 7, add $\frac{1}{4}$ $\frac{1}{2}$. Or,

3. The product of the principal by half the time in months, divided by 100, will be the interest at 6 per cent; and for 7, add $\frac{1}{2}$ of the interest at 6 per cent. Or,

4. Take the aliquot parts of 100, with half the time in months, for the interest at 6 per cent.

5. If the interest be required in Federal money, multiply the principal by 16, and separate the product of the pounds for the interest in dollars and cents, at 6 per cent. Or,

6. If the principal be in dollars, and the interest required in pounds at 6 per cent. multiply by $2\frac{1}{2}$, and divide by 100.

PROOF.

Work by a different method; or, by the double rule of three.

EXAMPLES.

1. What is the interest of £.112 15 8 for 5 years, at 6 per cent?

RULE 1.

£. s. d.	£. s. d.
112 15 8	6 15 4
6	5
<hr/>	
£. 6 | 76 14 0	£. 33 16 8 Answer.
20	

RULE 2.

£. s. d.
2,0)11,2 15 8
<hr/>
$\frac{1}{2}$ 5 12 9 $\frac{1}{4}$
1 2 6 $\frac{1}{4}$ near
<hr/>
6 15 4 $\frac{1}{4}$
5

s. 15 | 34
12

d. 4 | 08

£. 33 16 8 An.

RULE 3.

5 Yr.=60mo.	£. s. d.
	112 15 8
	5
Half time 30	
	563 18 4
	6

RULE 4.

mo. £. s. d.
25 $\frac{1}{2}$ | 112 15 8
<hr/>
5 $\frac{1}{2}$ | 28 3 11
<hr/>
5 12 9 $\frac{1}{4}$
<hr/>
£. 33 16 8 $\frac{1}{4}$

1,00)33,83 10 0

£. 33 16 8 $\frac{1}{4}$

$$\begin{array}{l} \text{If } x\phi\phi_{\mathcal{L}} \} \phi_{\mathcal{L}} \} \mathcal{L}.112 \ 15 \ 8 \\ \quad 1.\text{yr.} \} 3 \} \quad \text{gyrs. } 3 \end{array}$$
$$\begin{array}{r} 2) \cancel{20} \\ \hline 10 \end{array} \quad \begin{array}{r} 10) 338 \ 7 \ 0 \\ \hline \text{£.} 33 \ 16 \ 8 \frac{1}{4} \text{ proof.} \end{array}$$

2. What is the interest, in federal money, of £.987 18 11 for a year, at 6 per cent? Also, of dollars 2694 52 cents (equal to the above sum.) in pounds, for the same time, and at the same rate?

RULE 5.

£.	s.	d.
987	18	11
		4

3951 15 8
4

RULE 6.

Dolls.	cts.
2634	52

5269 04
658 63

Dollars 158 07 Answer.

1,00)59,27 67

Proof $\pounds.59 \times 6 = \text{Ds. } 450 \text{ cts.}$

3. What is the interest of £.350 17 8 for one year, at 6 per cent? Answer.....£.21 1 0½.

4. What is the amount of a bond for £.353 7 6, continuing 9 years, at 5 per cent?

Answer..... £5 12 7 10

5. What is the interest of £.548 7 9 for 8¹/₂ years, at 6¹/₄ per cent per annum?

	L.	S.	d.
I) 548	7	9	6

L. s. d.
85 18 10 1/2
B

\$290 6 6
274 3 10

£.285 3 2 Answer.

64 10 4
20

12 | 90 &c.

6. What is the interest of a bond for £.427 18 9 for 2 years, at $5\frac{3}{4}$ per cent? Answer..... £.49 4 3.

7. At 6 per cent, what will a legacy of 2514 dollars amount to, in 7 years?

Answer.....3569 dollars 88 cents.

8. What is the amount of a bond of 1000 dollars for 3 years, at $7\frac{1}{4}$ per cent?

Answer.....1217 dollars 50 cents.

CASE 2.

When the time is months, weeks, or days, less or more than a year.

RULE.

1. Find the interest of the given sum for a year; then work by the single rule of three direct for the months, weeks, or days. Or,

2. Of the interest for a year, take aliquot parts for the time less, or more than a year: if less, their sum will be the interest nearly; if more, add them to the yearly interest. Or,

3. From the product of the principal by the months, cut off one figure of the pounds to the right, those on the left hand will be the interest in shillings, at 6 per cent. The figure cut off will be pence, increasing it by 1, if it be above 4, and by 2 when above 7. Or,

4. Take such aliquot parts of the principal, as the years and months, considered as shillings and pence, would be of a pound, for the interest at 5 per cent. Or,

5. Multiply the principal by the days, and divide the product by 73, excepting two figures in every dividend. This gives the interest at 5 per cent: Or,

6. Reduce the days to months of 30 days each; take half the months for a multiplier, and parts for the half overplus days, if any; the product, or sum, divide by 100, for the interest, nearly, at 6 per cent. Then the sum of the months, &c. (excepting the unit figures) divide by 3; the quotient, which will be pence, deduct from the above interest, for the true interest. Or,

7. If the principal be in dollars; multiply by half the months, for the interest in cents, at 6 per cent. If there

RULE 5.

$\begin{array}{r} \text{£. s.} \\ 327 \ 10 \\ \hline 3 \times 7 \times 10 = 210 \\ \hline 982 \ 10 \\ 7 \\ \hline 6877 \ 10 \\ 10 \\ \hline 73)687,75 \ 0 \quad \text{£. s. d.} \\ \quad \quad \quad (9 \ 8 \ 3 \\ 657 \quad \frac{1}{2} \quad 1 \ 17 \ 8 \\ \hline 3075 \quad \text{£.11} \ 6 \ 1 \text{ int.} \\ 20 \\ \hline 615,00 \\ 584 \\ \hline 31 \ \&c. \end{array}$

RULE 6.

$\begin{array}{r} 3,0)21,0 \\ \hline 7 \text{ mo. } \text{£. s.} \\ \frac{1}{2})327 \ 10 \\ \hline \text{Half time } 3\frac{1}{2} \quad 3 \\ \hline 98)2 \ 10 \quad 3) \\ 16)3 \ 15 \quad 114 \\ \hline \text{£.11} \ 46 \ 5 \ 12)38 \\ \quad \quad \quad 20 \\ \hline \text{s.} \ 9)25 \quad \text{s.} \ 3 \ 2 \\ \quad \quad \quad 12 \\ \hline \text{d. } 3)00 \\ \hline \text{£. s. d.} \\ 11 \ 9 \ 3 \\ \quad \quad 3 \ 2 \text{ deduct.} \\ \hline \text{£.11} \ 6 \ 1 \text{ int.} \end{array}$

3. What is the interest of 960 dollars, for 6 months, at 6 per cent.? Also, for 4 months and 21 days?

RULE 7.

Dollars 960
 Half time 3 mo.
 \hline
 Cents 2880 = 28 Ds. 80 cts. int.

RULE 8.

6 mos. = $182 \frac{1}{2}$ Days.
 960 Dols.
 \hline
 10920
 1638
 480
 \hline Ds. cts.
 6083)175200(28 80 int.
 12166
 \hline
 5354 &c.

RULE 7.

Dols.

960

 $\frac{1}{3}$ of 4 mo. and $\frac{1}{8}$ of 21 days = 2,3 $\frac{1}{2}$

2880

192

480

Dols. cts.

Mills 22560 = 22 56 int.

4. What is the interest of a note for 862 dollars, for 2 years, 4 months and 24 days, at 6 per cent.?

Answer.....Ds. 124 8 cts.

5. What is the interest of £.85 12 6 for 120 days, at the rates 5, 6, and 7 per cent?

Answer..... $\left\{ \begin{array}{l} \text{£.1 } 8 \frac{1}{2} \text{ at 5.} \\ \text{1 } 13 \frac{9}{4} \text{ at 6.} \\ \text{1 } 19 \frac{3}{4} \text{ at 7.} \end{array} \right.$

6. What is the amount of a bond for £.301 18, for 1 year and 8 months at 6 per cent?

Answer.....£.332 1 9 $\frac{1}{2}$

7. What is the interest of £.126 12 for 16 weeks, at $4\frac{1}{2}$ per cent?

Answer.....£.1 15 0 $\frac{1}{2}$

8. A bond for £.325 10 6 was given the 26th. 9th. month 1794, and taken up the 20th. 6th. month 1799; required the interest due thereon at 6 per cent?

Answer.....£.92 9 3 $\frac{1}{2}$

9. What interest is due on a legacy of £.517 12 8 $\frac{1}{2}$ for 5 years, 11 months and 25 days at 6 per cent per annum?

Answer.....£.185 17 7 $\frac{1}{2}$

10. What is the interest of one farthing from the creation to Anno Domini 1800, at 7 per cent per annum?

Answer.....8s. 5 $\frac{1}{2}$ d.

11. A father left his daughter £.2606 4, to be at interest until she attained the age of eighteen; at his decease she was 13 years and 73 days old; what is the amount of her legacy, computing interest at 7 per cent per annum?

Answer.....£3481 17 7.

12. A owes B the following sums, with interest due on them, at 6 per cent. per annum, viz. £.120, for 7 months, £.300, for 15 months, £.151, for 9 months, £.291 10,

for 27 months, and £.795 4, for $.45\frac{1}{2}$ months; what is the whole amount of the principal and interest?

Answer.....£.1911 9 $1\frac{1}{2}$

13. A bond for £.540 was due 13th 8 mo. 1796. Paid on the 19th 3 mo. 1797, £.50; the 19th 12 mo. following £.25; the 23d 9 mo. 1798, £.25; and on the 18th 8 mo. 1799, £.110; required the balance due on said bond, on the 11th 11 mo. 1799; interest computed at 6 per cent.?

Bond due 13th 8 mo. 1796.....£.540 0 0

Interest to 19th 3 mo. 1797—218 days.... 19 7 0

559 7 0

Paid 19th 3 mo. 1797..... 50 0 0

Balance due 19th mo. 3 mo. 1797.....509 7 0

Interest to 19th 12 mo. 1797—275 days..... 23 0 6

532 7 6

Paid 19th 12 mo. 1797..... 25 0 0

Balance due 19th 12 mo. 1797.....507 7 6

Interest to 23d 9 mo. 1798—278 days.... 23 3 $8\frac{1}{2}$

530 11 $2\frac{1}{2}$

Paid 23d 9 mo. 1798.....(0)..... 25 0 0

Balance due 23d 9 mo. 1798.....505 11 $2\frac{1}{2}$

Interest to 18th 8 mo. 1799—329 days... 27 6 $9\frac{1}{2}$

532 18 0

Paid 18th 8 mo. 1799.....110 0 0

Balance 18th 8 mo. 1799.....422 18 0

Interest to 11th 11 mo. 1799—84 days.... 5 18 $2\frac{1}{2}$

Balance due 11th 11 mo. 1799.....Ans. £.428 16 $2\frac{1}{2}$

14. A lends to, and receives of B, as per following statement, interest computed at 6 per cent, viz.

1. 2.

1801.	Dols.	Days.	Products.
1 mo. 1st. Lent	350	on int. for 60	= 21000
3 mo. 2nd. do.	280		
	<u>630</u>	on do.	30 = 18900
4 mo. 1st. Rec'd.	250		
	<u>380</u>	on do.	61 = 23180
6 mo. 1st. Lent	720		
	<u>1100</u>	on do.	30 = 33000
7 mo. 1st. Rec'd.	500		
	<u>600</u>	on do.	92 = 55200
10 mo. 1st. Rec'd.	200		
	<u>400</u>	on do.	92 = 36800
1802.			
1 mo. 1st. Rec'd.	250		
	<u>150</u>	on do.	20 = 3000
20th,			<u>Ds.cts.</u>
Time of settlement			6083)191080(31 41
			18249 <u> </u>
	Dols.		8590 &c.
Prin. remaining.....	150 00		<u> </u>
Interest.....	31 41		
	<u>Dols. 181 41</u>		
		Bal. due to A.	

CASE 3.

Interest as computed at the Banks,

RULE.

1. The product of the dollars by the days divide by 6 ; separate three figures to the right hand, those on the left will be the interest in dollars ; the next two will be cents.
Or,

2. Separate two figures to the right of the dollars for cents ; those on the left will be dollars ; together, they will be the interest for 60 days ; and, for time less, or more, take aliquot parts. Or,

3. When the days will divide evenly by 6, multiply the dollars by the quotient for the interest in mills.

EXAMPLES.

1. What is the interest of 2750 dollars, for 90 days, at 6 per cent? Also, for 60, for 30, and for 20 days, at the same rate?

RULE 1.

Dols. 6)
2750 \times 90 = 247500

Ans. Dols. 41 250 for 90 days.

RULE 2.

$30\frac{1}{2}$) 27,50
13,75

Dols. 41,25 Ans.

Days. Dls. cts.

$30\frac{1}{2}$) 27 50 for 60 days.

$20\frac{1}{2}$) ———

13 75 for 30 days.

Dols. 9 16 $\frac{1}{2}$ for 20 do.

RULE 3.

2750

$60 \div 6 = 10$

Ds. cts.

Mills 27500 = 27 50
for 60 days.

2. What is the interest of 3520 dollars for 54 days?

Answer.....Dls. 31 68cts.

3. What is the interest due on a note for 5760 dollars, for 50 days?

Answer.....Dls. 48.

4. Tell the amount of a bond for 4760 dollars, for 180 days?

Answer.....Dls. 4902 80cts.

5. A is indebted to the bank of the United States, as in the following statement; what sum has he to account for?

1801.	Dols.	Days	Product.
7mo. 20th.	2384	for 120 =	286080
	1985	90 =	178650
	2756	60 =	165360
	4960	30 =	148800

Prin. 12085 6,000) 778,890

Int. 129 81 5

Int. 129 81 5

Dols. 12214 81cts. 5m. Ans.

6. The value of a ship and cargo is 17120 dollars ;
what is the insurance at $17\frac{1}{2}$ per cent.?

Answer.....2996 Dollars.

CASE 5.

To find the principal, when the amount, time, and rate
per cent. are given ;

RULE.

Find the amount of £.100, at the rate and time given :

As this sum,

Is to £.100 ;

So is the sum given,

To the principal, or present worth.

EXAMPLES.

1. What principal, at 5 per cent. in 9 years, will a-
mount to £.725?

As £. 145 :: £. 100 :: £. 725

£.
5
9

45 Int.
100 Prin.

145 Amount.

100
145)72500(500 Answer.
725
000

2. What sum at interest for 9 years and 6 months, at
 $4\frac{1}{2}$ per cent, will amount to Dols. 556 50cts.?

Answer.....600 dols.

CASE 6.

To find the rate per cent. when the amount, time, and
principal are given ;

RULE.

As the principal,

Is to the interest for the whole time,

So is £.100,

To the interest for the same time :

Which interest, divided by the time, will give the rate.

EXAMPLES.

1. At what rate per cent. per annum will £.500 amount to £.725, in 9 years?

$$\begin{array}{r}
 \text{£.} \\
 725 \\
 \underline{500} \\
 225
 \end{array}
 \quad
 \begin{array}{r}
 \text{As } 500 \text{ .. } 225 \text{ :: } 100 \\
 \underline{100} \\
 9) \\
 500)22500(45 \\
 2000 \text{ —} \\
 \underline{2500} \text{ —} \\
 2500 \text{ —} \\
 \underline{\hspace{1cm}} \\
 0
 \end{array}$$

£.5 Answer.

2. At what rate per cent. per annum, will 600 dols. amount to 856 dols. 50cts. in 9 years and 6 months?

Answer.....£.4½

CASE 7.

To find the time, when the principal, amount, and rate per cent. are given;

RULE.

Divide the whole interest by the interest of the principal for one year; the quotient will be the time.

EXAMPLES.

1. In what time will £.500, amount to £.725, at 5 per cent. per annum?

$$\begin{array}{r}
 \text{£.} \\
 500 \\
 \underline{5} \\
 \text{£.25} | 00
 \end{array}
 \quad
 \begin{array}{r}
 \text{£.} \\
 725 \\
 \underline{500} \\
 225
 \end{array}$$

Years.

25)225(9 Answer.

225

0

2. In what time will 600 dols. amount to dols. 856 50 cts. at 4½ per cent. per annum?

Answer.....yrs, 9 6 mo.

3. A testator left his son £.6000, to receive the amount thereof at 5 per cent, when 21 years of age, which was then found to be £.8775; how old was the son at the decease of his father? Answer.....yrs. 11 9 mo.

A TABLE,

For finding the interest of any sum of money for any number of months, weeks, or days, at any rate per cent.

Year.	Calen. month.	Week.	Day.
£.	£. s. d.	£. s. d.	£. s. d.
1	0 1 8	0 0 4½	0 0 0½
2	0 3 4	0 0 9	0 0 1½
3	0 5 0	0 1 1½	0 0 2
4	0 6 8	0 1 6½	0 0 2½
5	0 8 4	0 1 11	0 0 3½
6	0 10 0	0 2 3½	0 0 4
7	0 11 8	0 2 8½	0 0 4½
8	0 13 4	0 3 0½	0 0 5½
9	0 15 0	0 3 5½	0 0 6
10	0 16 8	0 3 10½	0 0 6½
20	1 13 4	0 7 8½	0 1 1½
30	2 10 0	0 11 6½	0 1 7½
40	3 6 8	0 15 4½	0 2 2½
50	4 3 4	0 19 2½	0 2 8½
60	5 0 0	1 3 1	0 3 3½
70	5 16 8	1 6 11	0 3 10
80	6 13 4	1 10 9½	0 4 4½
90	7 10 0	1 14 7½	0 4 11½
100	8 6 8	1 18 5½	0 5 5½
200	16 13 4	3 16 11	0 10 11½
300	25 0 0	5 15 4½	0 16 5½
400	33 6 8	7 13 10	1 1 11
500	41 13 4	9 12 3½	1 7 4½
600	50 0 0	11 10 9	1 12 10½
700	58 6 8	13 9 2½	1 18 4½
800	66 13 4	15 7 8½	2 3 10
900	75 0 0	17 6 1½	2 9 3½
1000	83 6 8	19 4 7½	2 14 9½
2000	166 13 4	38 9 2½	5 9 7
3000	250 0 0	57 13 10	8 4 4½
4000	333 6 8	76 18 5½	10 49 2½
5000	416 13 4	96 3 0½	13 13 11½
6000	500 0 0	115 7 8½	16 8 9½
7000	583 6 8	134 12 3½	19 3 6½
8000	666 13 4	153 16 11	21 18 4½
9000	750 0 0	173 1 6½	24 13 7½
10000	833 6 8	192 6 4½	27 7 11½
20000	1666 13 4	384 12 3½	54 15 10½
30000	2500 0 0	576 18 5½	82 3 10
40000	3333 6 8	769 4 7½	109 11 9
50000	4166 13 4	961 10 8	128 10 8

TO APPLY THE PRECEDING TABLE IN CALCULATING
INTEREST.

Multiply the principal by the rate, and that product by the time; this last product divide by 100 : the collected interest from the table, against the numbers of the quotient, will be the interest required; adding 2d. for every 10 cut off in months, 1d. for every 20 in weeks, and 1 qr. for every 40 in days.*

At a certain income per annum, to find by the table how much per week, month, or day :

Collect from the table, opposite the given numbers, for the answer. And for more than one month, &c. multiply the sum by the months, weeks, &c. given.

EXAMPLES.

1. What is the interest, and what the amount of £.301 18s. for 20 months, at 6 per cent? See case 2. ex. 6.

£.	s.		£.	s.	d.
301	18		300 =	25	0
		- 6 per cent.	60 =	5	0
			2 =	3	4
				add	5½
1811	8		Interest £.	30	3
		4 × 5 = 20		301	18
					0
7245	12		Amount £.	332	1
	5				9½
160)362|28	0				
362					

* The foregoing table is calculated by dividing any number by the integral parts of a year : thus, £.100 ÷ 12 = £.8 6s. 8d. by 365, = £.2 18 5½; and by 365, = 5s. 5d. 4, &c.

2. Tell the interest of £.126 12s. for 16 weeks, at $4\frac{1}{2}$ per cent.? See case 2, ex. 7.

$\begin{array}{r} \text{£. s.} \\ 126 \ 12 \\ \underline{\hspace{1cm}} \\ 4\frac{1}{2} \\ \underline{\hspace{1cm}} \\ 506 \ 8 \\ 63 \ 6 \\ \underline{\hspace{1cm}} \\ 569 \ 14 \end{array}$	$\begin{array}{r} \text{£. s. d.} \\ 90 = 1 \ 14 \ 7\frac{1}{4} \\ 1 = 4\frac{1}{2} \\ \text{add} \phantom{7\frac{1}{4}} \phantom{4\frac{1}{2}} \phantom{7\frac{1}{4}} \\ \underline{\hspace{1cm}} \\ 15 \ 0\frac{1}{2} \text{ Facit,} \end{array}$
--	---

$569 \ 14 \times 16 = \text{£.}91|15 \ 4s.$

3. What is the interest of £.327 10s. for 210 days, at 6 per cent? See case 2. ex. 2

$\begin{array}{r} \text{£. s.} \\ 327 \ 10 \\ 6 \\ \underline{\hspace{1cm}} \\ 1965 \ 0 \\ 210 \\ \underline{\hspace{1cm}} \\ 19650 \\ 3930 \\ \underline{\hspace{1cm}} \\ 4126 50 \end{array}$	$\begin{array}{r} \text{£. s. d.} \\ 4000 = 10 \ 19 \ 2\frac{1}{4} \\ 100 = 5 \ 5\frac{1}{4} \\ 20 = 1 \ 1\frac{1}{4} \\ 6 = 4 \\ \text{add} \phantom{1\frac{1}{4}} \phantom{1\frac{1}{4}} \\ \underline{\hspace{1cm}} \\ 11 \ 6 \ 1\frac{1}{2} \text{ Answer.} \end{array}$
---	---

4. At £.365 per annum, what is that per month, week, and day?

$\begin{array}{r} \text{£. s. d.} \\ 300 = 25 \ 0 \ 0 \\ 60 = 5 \ 0 \ 0 \\ 5 = 8 \ 4 \end{array}$	$\begin{array}{r} \text{£. s. d.} \\ 5 \ 15 \ 0\frac{1}{4} \\ 1 \ 3 \ 0\frac{1}{4} \\ 1 \ 11 \end{array}$	$\begin{array}{r} \text{£. s. d.} \\ 0 \ 16 \ 5\frac{1}{4} \\ 3 \ 3\frac{1}{4} \\ 3\frac{1}{4} \end{array}$
---	---	---

Answer £.30 8 4 Mo. £.7 0 0 Wk. £.1 0 0 Day.

5. An estate lets for £.450 per annum; how much is that for 3 months, 2 weeks and 3 days?

$$\text{£.}450. \begin{cases} 1 \text{ mo.} = \text{£.}37 \ 10 \ 0 \times 3 \text{ mo.} = \text{£.}112 \ 10 \ 0. \\ 1 \text{ wk.} = \phantom{\text{£.}37} 8 \ 13 \ 0\frac{1}{4} \times 2 \text{ wk.} = \phantom{\text{£.}37} 17 \ 6 \ 1\frac{1}{2}. \\ 1 \text{ da.} = \phantom{\text{£.}37} 1 \ 4 \ 7\frac{1}{4} \times 3 \text{ da.} = \phantom{\text{£.}37} 6 \ 3 \ 2\frac{1}{4}. \end{cases}$$

Answer.....£.135 19 4 $\frac{1}{4}$

A TABLE OF DAYS,
FOR ANY GIVEN TIME LESS THAN A YEAR.

Days.	1st. mon.	2d. mon.	3d. mon.	4th. mon.	5th. mon.	6th. mon.	7th. mon.	8th. mon.	9th. mon.	10th. mon.	11th. mon.	12th. mon.
1	1	32	60	91	121	152	182	213	244	274	305	335
2	2	33	61	92	122	153	183	214	245	275	306	336
3	3	34	62	93	123	154	184	215	246	276	307	337
4	4	35	63	94	124	155	185	216	247	277	308	338
5	5	36	64	95	125	156	186	217	248	278	309	339
6	6	37	65	96	126	157	187	218	249	279	310	340
7	7	38	66	97	127	158	188	219	250	280	311	341
8	8	39	67	98	128	159	189	220	251	281	312	342
9	9	40	68	99	129	160	190	221	252	282	313	343
10	10	41	69	100	130	161	191	222	253	283	314	344
11	11	42	70	101	131	162	192	223	254	284	315	345
12	12	43	71	102	132	163	193	224	255	285	316	346
13	13	44	72	103	133	164	194	225	256	286	317	347
14	14	45	73	104	134	165	195	226	257	287	318	348
15	15	46	74	105	135	166	196	227	258	288	319	349
16	16	47	75	106	136	167	197	228	259	289	320	350
17	17	48	76	107	137	168	198	229	260	290	321	351
18	18	49	77	108	138	169	199	230	261	291	322	352
19	19	50	78	109	139	170	200	231	262	292	323	353
20	20	51	79	110	140	171	201	232	263	293	324	354
21	21	52	80	111	141	172	202	233	264	294	325	355
22	22	53	81	112	142	173	203	234	265	295	326	356
23	23	54	82	113	143	174	204	235	266	296	327	357
24	24	55	83	114	144	175	205	236	267	297	328	358
25	25	56	84	115	145	176	206	237	268	298	329	359
26	26	57	85	116	146	177	207	238	269	299	330	360
27	27	58	86	117	147	178	208	239	270	300	331	361
28	28	59	87	118	148	179	209	240	271	301	332	362
29	29		88	119	149	180	210	241	272	302	333	363
30	30		89	120	150	181	211	242	273	303	334	364
31	31		90		151		212	243		304		365

THE USE OF THE TABLE.

1. To find the number of days from the beginning of the year to any day in any month :

This is obtained by inspection.

2. To find the number of days, from any given time, to the end of the year :

Suppose 9 mo. 10th.

From	365
Take	253 = 9 mo. 10th.
<hr/>	
Remains	112 Days.

3. To find the number of days between different dates :

Suppose the 5 mo. 9th. and 11 mo. 5th.

From	309 = 11 mo. 5th.
Take	129 = 5 mo. 9th.
<hr/>	
Remains	180 Days.

4. To find the number of days, from a given date, to some other in the year following :

Suppose 10 mo. 12th. to 6 mo. 10th. ensuing.

From	365
Take	285 = 10 mo. 12th.
<hr/>	
	80
add	161 = 6 mo. 10th.
<hr/>	
	241 Days.

If the 2d mo. of leap year be included, 1 day must be added.

COMPOUND INTEREST.

COMPOUND interest is that, which arises from the accumulated interest, added annually to its principal.

RULE.

Find the interest of the sum, at the given rate, for one year; which interest added to the principal, will be the principal for the second year. Find the amount of this sum for a third principal; and so proceed.

The principal taken from the amount, leaves the whole compound interest.

PROOF.

Reduce the principal to dollars, and find their interest at 5 per cent; and for 6, or 7, add as taught in simple interest.

EXAMPLES.

1. What will a bond for £.900 amount to in 3 years, at 5 per cent per annum? And what is the compound interest?

	£.	s.	d.	
20	900	0	0	Principal 1st. year.
	45	0	0	
<hr/>				
20	945	0	0	Principal 2d. do.
	47	5	0	
<hr/>				
20	992	5	0	Principal 3d. do.
	49	12	3	
<hr/>				
	1041	17	3	Amount.
	900	0	0	
<hr/>				
	£.141	17	3	Compound interest.

	Dols.	£.	
20	2400	= 900	
	120		
	—		
20	2520		
	126		
	—		
20	2646	Cts.	
	132	30	
	—		
	£.	s.	d.
Amount Dols.	2778	30 = 1041	17 3
Principal	2400		
Interest	378	30 = 141	17 3
			} Proof.

2. What sum will £.800 amount to in 4 years, at 6 per cent per annum? Answer.....£.1009 19 7.

3. What is the compound interest of £.500 for 4 years, at $4\frac{1}{2}$ per cent per annum? Answer.....£.90 11 $5\frac{1}{2}$

4. A bond for £.480, annually renewed for 6 years, at 5 per cent, what is its value?

Answer.....£.643 4 10 $\frac{1}{2}$

5. What is the compound interest, and what the amount of a bond for 7525 dollars 75 cents, for 3 years, at 6 per cent per annum? Interest dols. 1437 53cts.

Amount 8963 28

REBATE OR DISCOUNT.

REBATE or Discount, is a rule for finding what must be taken from a given sum, that the remainder, being placed at interest for a time specified, will amount to the sum given.

RULE.

Find the present worth, as in case 5 simple interest. Subtract the present worth from the given sum, and the remainder will be the rebate.

PROOF.

The amount of the present worth, at the rate, and for the time, will equal the sum given.

EXAMPLES.

1. What is the rebate of £.795 11 2 for 11 months, at 6 per cent per annum?

Mo.	£.	Mo.	£.	s.	£.	£.	s.	d.
As 12	6	:: 11	As 105	10	:: 100	795	11	2
11			20			20		
12)66			2110			15911		
			12			12		
5 10								
100 0			25320			190934		
						100		
£.105 10						£. s. d.		
			25320			19093400	754	1 8
						177240		

136940 &c.

£. s. d.
795 11 2
Present worth 754 1 8

Rebate. £.41 9 6 Ans.

£. s. d.
20)754 1 8
5) 37 14 1 Int. at 5.
7 10 9 $\frac{3}{4}$

Mo.
6 $\frac{1}{2}$ | 45 4 10 $\frac{3}{4}$
4 $\frac{1}{3}$ |
1 $\frac{1}{4}$ | 22 12 5 $\frac{1}{4}$
15 1 7 $\frac{1}{3}$
-3 15 4 $\frac{1}{4}$

41 9 5 $\frac{1}{2}$
754 1 8

£.795 11 1 $\frac{1}{2}$ Proof.

2. What is the present worth of £.161 10 for 19 months, at 5 per cent? Answer.....£.149 13 0 $\frac{1}{2}$.

3. How much ready money for a note of £.18 due 15 months hence, at 5 per cent?

Answer.....£.16 18 9 $\frac{1}{4}$.

4. Sold goods for £.112 12 to be paid 20 months hence; what is the present worth at 7 per cent?

Answer.....£.100 16 8 $\frac{1}{2}$.

5. What is the present worth of £.100, one-half payable at 4 months, and the other half at 8 months; discount at 5 per cent? Answer.....£.97 11 4.

6. What is the present worth of 1000 dollars payable in one year at 6 per cent?

Answer.....943 dollars 39 cents.

7. What difference is there between the interest of 1500 dollars at 5 per cent per annum, for 12 years, and the discount of the same sum, at the same rate, and for the same time? Answer.....337 dolls. 50 cts.

EQUATION.

EQUATION of time, for the payment of money, reduces several times; at which money is payable, to one proportionate time for the payment of the whole, without loss to either debtor or creditor.

RULE.

The sum of the products of the payments with their respective times, divided by the sum payable at the time required, will be the equated time.

PROOF.

The interest of the sum, payable at the equated time, at any rate per cent, will equal the interest of the several payments for their respective times, at the same rate.

EXAMPLES.

1. A. owes B. £.380; whereof £.100 is to be paid at the end of 6 months, £.120 at 7 months, and £.160 at 10 months; what is the equated time for the payment of the whole?

£.	Mo.	£.		£.	Mo.	£. s.
100	×	6	=	600	Interest of	100 for 6=3 0
120	×	7	=	840		120 7=4 4
160	×	10	=	1600		160 10=8 0
				Mo.		
380	)	3040	(8 Answer.		£.15	4
		3040				
					Int. of £.380 for 8 mo.=	15 4 Proof.

2. F. owes H. £.1000, of which £.200 is to be paid present, £.400 at 5 months, and the rest at 10 months; the equated time for the payment of the whole is required?

Answer.....6 Months.

3. P. owes Q. £.420 due 6 months hence; on the paying £.60 present, what is the time for the payment of the remainder?

Answer.....7 Months.

4. A debt of 1000 dollars is to be discharged thus; 319 dollars 48 cents present, and the remainder at 50, 60, and 90 days, in equal payments: the equated time for the payment of the whole is required?

Answer.....45 + Days.

BARTER.

BARTER is the exchanging of one commodity for another; the parties rating their articles by mutual consent.

RULE.

Find the value of the given article; and, from the result, and the price of that required, find the quantity of the article sought. Or,

Where the exchange is simple, work by inverse proportion.

PROOF.

Work by a different rule.

EXAMPLES.

1. B. delivered 3 hogsheads of brandy, at 7s. 6d. a gallon, to E. for cloth at 11s. 3d. per yard; the number of yards is required?

Gal.	S.	d.	Yd.	£.	s.	d.
3 X 63 = 189	As	11	3	1	70	17 6
3		12		20		
<hr/>		<hr/>		<hr/>		
8) 567		135		1417		
<hr/>				12		
£. 70 17 6				Yds.		
<hr/>				135) 17010	126	Answer
				135		
				<hr/>		
				351	&c.	
				<hr/>		

D. G. D.
Inversely, As 90 :: 189 :: 135

$$\begin{array}{r} 45) \overline{2 3} \\ \underline{2 3} \\ 3) 378 \end{array}$$

Yds. 126 Answer.

2. Bartered 25 yards of linen at 2s. 6d. a-yard, for sugar, at 9d. the lb. the quantity of sugar is required?

Answer.....83 lb. 5oz.+

3. A. had 5 Cwt. of sugar, at 6d. per lb. which he bartered with B. for cinnamon, at 10s 8d. the lb. the quantity of cinnamon is required? Answer.....26 lb. 4oz.

Answer.....26 lb. 4oz

4. A. receives of B. 20 Cwt. of cheese, at 2ls. 6d. per Cwt. and gives him 8 pieces of linen, at £3. 14 the piece; which of them must receive money, and how much?

Answer.....A. £.8 2.

5. If 24 yards of Holland be given for 5 Cwt. 1qr. of tobacco, at 38s. 8d. per Cwt. what is the cloth rated a yard? Answer.....8s. 5½.

Answer.....8s. 5 $\frac{1}{2}$.

6. A barters 40 yards of linen at 7s. 4d. per yard, with B. for $28\frac{1}{2}$ lb. of tea, at 1s. 6d. the lb. which must pay balance, and how much? Answer.....A. £.1 14 5.

ver.....A. £.1 14 5.

7. K. has $7\frac{1}{2}$ Cwt. of sugar, at 16d. per lb. for which B. gave him $12\frac{1}{2}$ Cwt. of cheese; at what was the cheese rated per lb. ? Answer 9 $\frac{1}{2}$ d. +

Answer $9\frac{1}{8}$ d. $\frac{1}{2}$

8. What quantity of sugar, at 8d. per lb. must be given for 20 Cwt. of tobacco, at £.3 per Cwt.?

Answer.....16 Cwt. 8 lb.

9. A. has wine at 7s. 6d. the gallon ready money, but in barter will have 8s. 2d. B. has sugar at 9d. per lb. ready money; how ought B. to rate his sugar?

Answer..... $9\frac{1}{8}$ d. per lb. +

10. H. had 41 Cwt. of flour, at 4 dollars per Cwt. for which K. gave him £.20 in money, and the rest in beef at 5d. per lb. how much beef did K. give H.?

Answer.....1992 lb.

11. A. had $22\frac{1}{2}$ Cwt. of sugar, at 8d. per lb. for which B. gave him $37\frac{1}{2}$ Cwt. of flour; what was the flour per Cwt.?
- Answer.....44s. $9\frac{1}{2}$.+

Answer.....44s. $9\frac{1}{8}$. +

12. K. has 150 bushels of wheat at 1 dollar 80 cents

the bushel, for which L. gives him 165 bushels of barley worth 95 cents the bushel; and the balance in oats at 25 cts.; what quantity of oats must K. receive?

Answer.....453 Bushels.

13. R. has linen, at 26 cents per yard ready money, but in barter charges 30 cents. T. has cloth, at 4 dollars and 33 cents per yard, ready money; at what rate must T. value his cloth per yard, to be equivalent to R's bartering price; and how many yards of linen must be given by R. for 488 yards of T's cloth?

Answer..... { Cloth 4 dolls. 99 cts. 6 ms. per yd. +
and 8127 yards linen. +

14. Coffee bartered at 11 cents alb. more than the prime cost, for tea, at 1 dollar and 66 cents a lb. which cost 1 dollar and 33 cents; the prime cost of the coffee is required?

Answer.....44 cents 3 1/2 mills.

15. K. has 7 Cwt. 2qr. of sugar, at 16 cents the lb. for which L. gave him 12 Cwt. 2qr. of cheese; at what per lb. was the cheese rated? Answer.....9 cts. 6 ms.

16. Sugar at 11 cents the lb. and tobacco at 8 dollars the Cwt. how much of the former article must be given for 20 Cwt. of the latter?

Answer.....12ct. 3qr. 26 lb.

LOSS AND GAIN.

LOSS and Gain instructs merchants and traders, so to estimate their goods, in buying and selling; as to know what they gain or lose in dealing.

RULE.

As a single article;
Is to its gain or loss;
So are the articles given,
To their gain or loss. Or,

From the amount of sales, subtract the prime cost, and the remainder will be the gain; and from the prime cost, take the amount of sales, the remainder will be the loss.

If the gain or loss per cent be required ;
 As the prime cost,
 Is to the gain or loss ;
 So is £.100,
 To the gain or loss per cent.

PROOF.

Find the gain or loss, as the nature of the question may require, by a different rule.

EXAMPLES.

1. Bought 25 yards of linen, at 3s. 4d. per yard, and sold it at 4s. 6d. ; required the profit of that purchase and sale ?

S. d.	Yd. s. d. yds.
4 6 sold for.	If 1 - 1 2::25
3 4 prime cost.	12 14
<hr/>	<hr/>
1 2 gain per yard.	14. 100
<hr/>	<hr/>
	25
S.	
1 $\frac{1}{5}$ | 25	12)350
<hr/>	<hr/>
2d. $\frac{1}{6}$ | 1 5	2,0)2,9 2
4 2	<hr/>
<hr/>	<hr/>
£.1 9 2 Proof.	£.1 9 2 Ansr.

2. Bought 18 Cwt. of cheese, at £.4 4 per Cwt. which being retailed at 10 $\frac{1}{2}$ d. per lb. what was gained thereby ?
 Answer.....£.12 12.

3. Bought children's hose, at 20d. a pair, and sold them at 17d. what was lost on 120 dozen pair ?
 Answer.....£.18.

4. If a yard of cloth be bought for 13s 4d. and sold for 16s. what is the gain per cent ?
 Answer.....£.20.

5. Tobacco bought at £.4 13 4 per Cwt. and retailed at 11d. the lb. what is the gain per cent ?
 Answer.....£.10.

6. Bought goods for £.18, which being disposed of immediately for £.25 at 4 months credit, what was gained per cent per annum?

If £.18 } £.7 { £.100
Mo. 4 } Mo. 12 Answer.....£.116 13 4

7. Bought 300 lbs. of tea, at 4s. 2d. per lb. ready money which being sold at 5s. payable in 8 months, what was gained thereby, discount at 6 per cent, and how much per cent. per annum.

Gained £.9 12 3½, and £.30 per cent.

8. Bought a chest of tea, weighing 490 lb. for £.122 10, and sold it for £.135 16 8; what was the profit on each lb.?

Answer.....8d.

9. At 3d. profit on a shilling, what is that per cent.?

Answer.....£.25.

10. At 3s. 6d. per pound profit, how much per cent.?

Answer.....£.17 10.

11. Sold a yard of silk for 11s. 6d. by which was gained £.15 per cent, but if it had been sold at 12s. what would have been the gain per cent?

Answer.....£.20.

12. If by selling 1 lb. of pepper for 10½ there be 2d. lost, how much is the loss per cent?

Ans.....£.16.

13. Sold 12 yards of fine Holland, for 15 dols. 12 cts. by which was gained 20 per cent. what was the prime cost of a yard?

Answer.....1 d. 6 cts.

14. Bought sugar at 7 cts. a lb. and sold it at 7 dols. 50 cts. per cwt. what was the gain or loss per cent?

Answer.....4 ds. 33 cts. 6m. + loss.

15. Bought linen at 66 cts. per yard; how much may it be sold per yard, to gain 35 per cent?

Answer 89 cts. 1 m.

16. Sold 500 yards of dowlas, at 17 cts a yard, and 9 per cent loss; what was lost by that sale?

500 at 17 cts.=85 dols.

As 91 dols. :: 9 :: 85 dols. to 8 ds 40 cts. 6 ms. + Ans.

17. Bought cloth, at 2 dols. per yard, which proving damaged, is sold at 17 dols. 50 cts. per cent. loss; what was it sold for per yard?

Ans.....1 dol. 65 cts.

18. If 1 yard of cloth be sold at 78 cts. and thereby is gained 50 per cent, what was the prime cost of a yard?

Answer.....52 cents.

FELLOWSHIP.

FELLOWSHIP teaches persons, concerned in trade, to divide the gain or loss on any joint adventure, agreeably to their respective stocks, and the time of their continuance.

By this rule, legacies, the effects of bankrupts, &c. are also divided.

RULE.

1. If the time of the continuance of stocks be equal:
As the sum of the stocks,
Is to the whole gain or loss;
So is each man's stock,
To his share.
2. If stocks continue unequal periods; multiply each man's stock by its time. Then,
As the sum of the products,
Is to the whole gain or loss;
So is each man's product,
To his share.

PROOF.

The sum of the several shares must equal the gain or loss.

EXAMPLES.

1. A. B. and C. in trading, gained £.120; A. put in £.140, B. £.300, and C. £.160; what is each man's share of the gain?

	£.	As	£.	600	..	£.	120	::	£.	140	to	28	A.
B.	300		600	..	120	::	300	to	60	B.			
C.	160		600	..	120	::	160	to	32	C.			

} Answer.

Stock. 600.

£.120 Proof.

2. Three merchants, in a joint adventure, lost £.800 worth of goods: A's stock was £600, B's £.2400, and C's 1000; what must each man sustain of the loss?

Answer.....A. £.120, B. £.480, C. £.200.

3. The money and effects of a bankrupt amount to £.2801 9; he is indebted to H. £.742 12; to I. 641 19 8; and to K. £.987 19 9; what is each man's dividend?

$$\text{Answer.....} \left\{ \begin{array}{l} \text{H's } £.876 \ 16 \ 8\frac{1}{2} + \\ \text{I's } £.758 \ 0 \ 7\frac{1}{2} + \\ \text{K's } £.1166 \ 11 \ 7\frac{1}{2} + \end{array} \right.$$

4. A. put in stock £.120 for 9 months, B. £.100 for 16 months, and C. £.100 for 14 months; their gain was £.100; what was each man's share?

$$\begin{array}{rcl} \text{£.} & \text{Prod.} & \\ 120 \times 9 & = & 1080 \\ 100 \times 16 & = & 1600 \\ 100 \times 14 & = & 1400 \end{array}$$

$$\text{Sum. } 4080$$

$$\begin{array}{rcl} \text{Sum. } £. & \text{Sum. } £. \text{ s. d. q.} & \\ \text{As } 4080 :: 100 :: 1080 & \text{to } 26 \ 9 \ 4 \ 3\frac{1}{2} & \text{A's.} \\ 4080 :: 100 :: 1600 & \text{to } 39 \ 4 \ 3 \ 3\frac{1}{2} & \text{B's.} \\ 4080 :: 100 :: 1400 & \text{to } 34 \ 6 \ 3 \ 1\frac{1}{2} & \text{C's.} \end{array} \left. \vphantom{\begin{array}{rcl} \text{Sum. } £. & \text{Sum. } £. \text{ s. d. q.} & \right\} \text{Answer.}$$

$$£.100 \ 0 \ 0 \ \text{Proof.}$$

5. F. laid in stock, £.400 for 18 months, G. £.680 for 10 months, and H. £.120 for 2 years; they gained £.500; required each man's share?

$$\text{Answer.....} \left\{ \begin{array}{l} \text{F's } £.213 \ 5 \ 4\frac{1}{2} + \\ \text{G's } £.201 \ 8 \ 5 + \\ \text{H's } £.85 \ 6 \ 1\frac{1}{2} + \end{array} \right.$$

6. P. Q. and R. rent a pasture ground, for which they pay £.40 per annum; in which, P. had 20 oxen 76 days, Q. 18 for 50 days, and R. 25 for 90 days; required the quota for each to pay?

$$\text{Answer.....} \left\{ \begin{array}{l} \text{P. } £.13 \ 0 \ 4\frac{1}{2} + \\ \text{Q. } £.7 \ 14 \ 2 + \\ \text{R. } £.19 \ 5 \ 5\frac{1}{2} + \end{array} \right.$$

7. A. with a capital of £.100, began trade the 1st. of 1 mo. 1797, and took in B. as a partner on the 1st. 3 month following, with a capital of £.150. Three months after that, they admit C. who brought into stock £.180.

At the end of the year their gain is found to be £.355 6 :
how must it be divided among them ?

Answer..... { A. £.107 13 4.
 B. £.134 11 8.
 C. £.113 1.

8. A. B. and C. put in stock 7200 dollars, and gained 5400 dollars; of which, so often as A. took 3 dollars, B. took 5, and E. 7; what did each man put in, and gain?

Ans..... { A's stock dols. 1440, B's 2400, C's 3360.
 A's gain dols. 1080, B's 1800, C's 2520.

9. K. began trade with 3600 dollars, L. advanced his capital 4 months after; required the sum he put in, so as at the year's end to claim equal profits with K. ?

Answer.....5400 dollars.

10. Three persons received 665 dollars interest; D's principal was 4000 dollars for 12 months, E's 3000 dollars for 15 months, and F. 5000 dols. for 8 months; what is each man's share?

Ans.....A. 240 dols.—B. 225 dols.—C. 200 dols.

EXCHANGE.

EXCHANGE is the reducing money of one state or country, to an equivalent sum of another state or country.

The par of exchange is fixed, it being the intrinsic value of the money of one country, compared with that of another; but various causes occasion the rise and fall of the course of exchange.

Agio is the difference between the Bank money of some foreign countries, and the current money of those countries.

Exchange is either Domestic or Foreign.

DOMESTIC EXCHANGE.

Domestic exchange is that which is current between the several United States; the dollars in some states having a different nominal value from that in some other states.

Accounts formerly in these states, were kept in pounds, shillings and pence; but latterly, by many, in dollars and cents.

To exchange the currency of each of the United States, to that of any other;

RULE.

By direct proportion, on the value of a dollar: See page 21; or, to exchange

FROM

New Hamps. Massachus. R. Isl. Connect. and Virginia.	Pennsylvania. Jersey, Del. ware and Ma- ryland.	New York, and North Caro- lina.	S. Carolina and Georgia.
TO	TO	TO	TO
Pennsylvania.	New Hamps.	New Hamps.	New Hamps.
Jersey, Del.	Massachus. R.	Massachus.	Massachus.
Maryland.	Isl. Connect.	Connect. and	R. Island,
Add $\frac{1}{2}$.	and Virginia.	Virginia,	Connect. and
	Deduct $\frac{1}{2}$.	Deduct $\frac{1}{2}$.	Virginia, add $\frac{2}{7}$; or $\times 9 \div 7$.
TO	TO	TO	TO
New York, and S. Carolina.	New York and N. Carolina.	Pennsylvania, Jersey, Del. ware and Ma- ryland.	Pennsylvania Jersey, Del. & Maryland.
Add $\frac{1}{2}$.	Add $\frac{1}{2}$.	Deduct $\frac{1}{15}$.	Add $\frac{1}{2}$, $\frac{1}{7}$ that $\frac{1}{2}$, and $\frac{1}{2}$ that $\frac{1}{7}$. or, $\times 11 \frac{1}{2} \div 7$.
TO	TO	TO	TO
S. Carolina and Virginia, sub- tract $\frac{2}{9}$.	S. Carolina and Georgia.	S. Carolina, and Georgia, to $\frac{1}{2}$	N. York and N. Carolina,
$\times 3 \frac{1}{2}$ and $\div 3$.		add $\frac{1}{2}$ of the $\frac{1}{2}$.	$\times 2 \frac{1}{2}$ prod.
		or, $\times 7 \div 12$.	or, $\times 12 \div 7$.
		or, $\div \frac{1}{2} \div 2$.	or, $\frac{1}{2}$ and doub. rem.

PROOF.

Work with the answer by the reverse rule, which will reduce the sum given.
All the examples in this case may be so proven, as they are no remainders.

£.	s.	d.
50 $\frac{1}{2}$	1887	14 10 $\frac{1}{2}$
10 $\frac{1}{2}$	943	17 5 $\frac{1}{2}$
2 $\frac{1}{2}$	188	15 5 $\frac{1}{2}$
2 $\frac{1}{2}$	37	15 1
	37	15 1

£.3095 17 11 $\frac{1}{2}$ Answer.

3. What sum sterling is £.1120 12s. 6d. Connecticut currency, exchange at par?

£.	s.	d.
As £. 1120	12	6
4	3	3
		4)3361 17 6

£.840 9 4 $\frac{1}{2}$ Answer.

4. A. of Jamaica, is indebted to B. of London £.1470 12s. 8d. sterling; what sum is it in Jamaica currency, exchange at 36 $\frac{1}{2}$ per cent?

Answer.....£.2007 8 3 $\frac{1}{2}$ +.

5. D. of Dublin draws upon L. of London, for £.1481 9s. Irish money; exchange at 12 per cent. How much sterling will discharge this bill?

Answer.....£.1322 14 5 $\frac{1}{2}$ +.

6. Philadelphia, 3d. 4mo. 1799.
Exchange for £.905. 1s. sterling.

Thirty days after sight of this my first of exchange, second and third of like tenor and date not paid, pay to Timothy Trust, or order, nine hundred and five pounds one shilling sterling, value received; and place the same to account as per advice from

PETER PAYWELL.

Simon Stephens, merchant, London.

What is the value of this bill in Pennsylvania currency, exchange at 77 $\frac{1}{2}$ per cent.?

Answer....£.1606 9 3 $\frac{1}{2}$ +.

7. How much sterling must be paid in London, to receive in Paris 758 crowns, exchange at 56d. per crown?

Answer.....£.176 17 4

8. At $54\frac{1}{2}$ d. per crown, what is the sterling value of 725 crowns, 17 sols, 7 deniers? Ans.....£.164 14 $0\frac{1}{4}$ +

9. A bill for 5049 pezos, 7 rials, 32 marv. being remitted to Cadiz; what sum, Pennsylvania currency, is equal thereto, at 7s. 6d. per pezo?

Answer.....£.1893 14 $11\frac{1}{4}$.

10. In 89641 quartas, how many pounds sterling, exchange at $39\frac{1}{2}$ d. per piastre?

Answer.....£.115 5 $2\frac{1}{4}$ +

11. A merchant shipped a quantity of flour, which heated him 593 mill reas, 250 reas; and received in return 17 quarter casks of wine; what did the shipment amount to; and what was the wine per cask, the mill rea being at par?

Amount.....£.166 17 $0\frac{1}{4}$ +

Per cask.....£.9 16 $3\frac{1}{2}$ +

12. In 420 rix dollars, 3 copper dollars, 16 rustics, how many pounds sterling, the exchange being at par?

Answer.....£.94 12 $4\frac{1}{4}$.

13. In 7681 guilders current money, how much sterling money, exchange at 3s. 6d. Bank money per £. sterling, agio at 5 per cent.?

G.C. G.B. G.C. G.B. St. Rm.

As 105.: 100.: 7681. to 7315 4 12.

s. d. £. G.B. s. p.

As 35. 6. 1.: 7315 4. 12. to £.686 17 $6\frac{1}{4}$ + Ans.

14. P. of Philadelphia, is indebted to L. of London, £.1474 16s. currency; what sum sterling will discharge the debt, exchange at 64 per cent.?

Answer.....£.699 5 $4\frac{1}{4}$ +

15. London receives a bill of exchange from Philadelphia for £.943 17 $5\frac{1}{4}$; for how much currency was London indebted, exchange at 64 per cent.?

Answer.....£.1547 18 $11\frac{1}{4}$.

16. A merchant remits to Hamburg, goods amounting to 5487 dollars, 50 cents; what number must he have in return, at 80 cents each?

Answer.....Dols. 6859. 50.cts.

17. London receives from the United States of America, goods to the value of 5040 dollars, 75 cents; how much is that in sterling money, the exchange being at par?

Answer.....£.1124 3 $4\frac{1}{4}$.

VULGAR FRACTIONS.

A FRACTION is a part, or parts of an integer ; as $\frac{1}{4}$, one-fourth ; $\frac{7}{8}$, seven-eighths, &c. the upper figure of which is called the numerator, and denotes the part or parts of the fraction ; the lower figure is called the denominator, and denotes the number of such parts contained in the integer.

Vulgar Fractions are either proper, improper, compound, or mixed.

A proper fraction is, when the numerator is less than the denominator ; as, $\frac{1}{2}$, $\frac{7}{8}$, $\frac{146}{438}$.

An improper fraction is, when the numerator is equal to, or greater than the denominator ; as $\frac{6}{6}$, $\frac{8}{3}$.

A compound fraction is, a fraction of a fraction ; as, $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$.

A mixed number consists of a whole number and a fraction ; as, $6\frac{2}{3}$.

REDUCTION.

Reduction of vulgar fractions reduces them in order for other operations.

CASE I.

To reduce fractions to their lowest terms ;

RULE.

Take aliquot parts of the given fraction continually.

Or,

Divide the lower term by the upper, then continually every divisor by the last remainder, till nothing is left ; the last divisor will be the common measure ; by which divide both terms of the fraction.

When the remainder is 1, the fraction is already in its lowest terms.

An equal number of ciphers to the right of fractions may be rejected ; thus, $\frac{4000}{7000} = \frac{4}{7}$.

EXAMPLES.

1. Reduce $\frac{896}{1112}$ to its lowest terms.

$$8) \frac{896}{1112} = \frac{112}{144} = \frac{14}{18} = \frac{7}{9} \text{ facit.}$$

$$896)1152(1 \qquad 128) \frac{896}{1112} = \text{as before.}$$

896

 256)896(3

768

 Common meas. 128)256(2

256

 0

2. Reduce $\frac{300}{800}$ to its lowest terms.....Facit $\frac{3}{8}$.

3. Reduce $\frac{114}{444}$ to its lowest terms.....Facit $\frac{1}{4}$.

4. Reduce $\frac{12712}{18112}$ to its lowest terms.....Facit $\frac{1}{2}$.

CASE 2.

To reduce fractions, of different denominators to equivalent ones, to have one common denominator;

RULE.

1. Reduce the given fractions to their lowest terms. Multiply, continually, each numerator by all the denominators but its own, for numerators, and all the denominators for a common denominator. Or,

2. Reduce the fractions as before. If any two, or more of the denominators have one common measure, divide them by it; divide the quotients, and the undivided denominators in like manner, until they all become prime to each other. Multiply the divisors, quotients, and the undivided numbers continually for a common multiple. Then, divide the multiple by each of the denominators, and multiply these quotients severally by the correspondent numerators for the numerators required; under which, place the multiple, for the least possible common denominator.

EXAMPLES.

1. Reduce $\frac{4}{8}$, $\frac{2}{4}$, $\frac{3}{8}$ and $\frac{7}{8}$, to a common denominator; and also, to the least possible common denominator.

1st. $\frac{4}{8} = \frac{2}{4}$ } Then $\frac{2}{4}$, $\frac{3}{8}$, $\frac{1}{4}$ & $\frac{7}{8} = \frac{192}{288}$, $\frac{216}{288}$, $\frac{96}{288}$ & $\frac{252}{288}$ Facit.
 2dly. $\frac{3}{8} = \frac{3}{8}$ }

That is, $\left\{ \begin{array}{l} 2 \times 4 \times 3 \times 8 = 192 \\ 3 \times 3 \times 3 \times 8 = 216 \\ 1 \times 3 \times 4 \times 8 = 96 \\ 7 \times 3 \times 4 \times 3 = 252 \end{array} \right\}$ Numerators,
 $\left\{ \begin{array}{l} 3 \times 4 \times 3 \times 8 = 288 \end{array} \right\}$ Denominator.

4) $\frac{2}{4}$, $\frac{3}{8}$, $\frac{1}{4}$, $\frac{7}{8}$
 $\frac{2}{4} \times 3 \times 2 = 24$ Common multiple.

3) 3 1 3 2

1 1 1 2 $24 \div 3, 4, 3 \text{ \& } 8, = 8, 6, 8 \text{ \& } 3$ } Multiply.
 2 3 1 7

16 18 8 21 Numer's.

Least denom. $\frac{16}{34}$, $\frac{18}{34}$, $\frac{8}{34}$ & $\frac{21}{34}$, Facit.

Which fractions are equal to those found above: for 24 into 288 = 12; and 12 divided into 192, 216, 96 and 252 respectively, gives 16, 18, 8 and 21.

2. Reduce $\frac{7}{8}$, $\frac{9}{10}$, and $\frac{4}{5}$, to the least common denominator. Facit $\frac{105}{120}$, $\frac{108}{120}$ and $\frac{112}{120}$.

3. Reduce $\frac{4}{7}$, $\frac{1}{2}$, $\frac{5}{6}$ and $\frac{1}{3}$, to the least common denominator. Facit $\frac{48}{84}$, $\frac{30}{84}$, $\frac{70}{84}$ and $\frac{16}{84}$.

4. Reduce $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{3}$, $\frac{5}{6}$ and $\frac{7}{8}$, to equivalent fractions, and the least common denominator.

Facit $\frac{12}{24}$, $\frac{16}{24}$, $\frac{8}{24}$, $\frac{20}{24}$ and $\frac{21}{24}$.

CASE 3.

To reduce a mixed number to an improper fraction;

RULE.

Multiply the whole number by the denominator of the fraction, taking into the product the numerator; under which, place the denominator.

EXAMPLES.

1. Reduce $19\frac{7}{8}$ to an improper fraction

$19 \times 8 + 7 = \frac{159}{8}$ Facit.

2. Reduce $36\frac{1}{3}$ to an improper fraction
Facit..... $29\frac{1}{3}$.
3. Reduce $127\frac{14}{17}$ to an improper fraction.
Facit..... $217\frac{14}{17}$.
4. Reduce $653\frac{1}{19}$ to an improper fraction.
Facit..... $12410\frac{1}{19}$.

CASE 4.

To reduce an improper fraction to a whole, or mixed number ;

RULE.

Divide the upper term by the lower. This, and case 3, prove each other.

EXAMPLES.

1. Reduce $159\frac{1}{8}$ to its proper terms.
8)159
—
197. Facit.
2. Reduce $56\frac{1}{17}$ to its proper terms.
Facit..... $56\frac{1}{17}$.
3. Reduce $127\frac{14}{17}$ to its proper terms.
Facit..... $127\frac{14}{17}$.
4. Reduce $12410\frac{1}{19}$ to its proper terms.
Facit..... $653\frac{1}{19}$.

CASE 5.

To reduce a compound fraction to a single one ;

RULE.

Multiply the numerators continually, also the denominators, for the fraction required.

If a mixed number be given, reduce it to an improper fraction ; and, to express a whole number fractionally, put 1 for the denominator.

Like numerators and denominators may be cancelled. Aliquot parts also of other fractions may be used in their stead.

EXAMPLES.

1. Reduce $\frac{2}{3}$ of $\frac{1}{4}$ of $\frac{4}{5}$ of $6\frac{2}{3}$ to a single fraction.
1st. $6\frac{2}{3} = \frac{20}{3}$. Then, $\frac{2}{3}$ of $\frac{1}{4}$ of $\frac{4}{5}$ of $\frac{20}{3} = \frac{4}{3}$. Facit, $= 2\frac{2}{3}$.
Cancelled, $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{20}{3} = \frac{8}{3} = 2\frac{2}{3}$, as before.
2. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{1}{4}$ to a single fraction.
Facit..... $\frac{1}{12}$.
3. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{1}{4}$ of $12\frac{1}{4}$ to a single fraction.
Facit..... $3\frac{1}{8}$.
4. Reduce $\frac{2}{3}$ of $\frac{1}{4}$ of $\frac{1}{5}$ of 20 to a single fraction,
in its lowest terms. Facit..... $2\frac{2}{15}$.

CASE 6.

To reduce a fraction of one denomination to that of another, retaining the same value.

RULE.

- If to a greater denomination; make the given fraction a compound fraction, by comparing it with all the denominations between it and that to which it is to be reduced; which fractions, reduce to a single one.
- If to a less denomination; multiply the numerator, as above, for the numerator required.

EXAMPLES.

1. Reduce 3 farthings, to the fraction of a pound.
 $\frac{3}{4}$ of $\frac{1}{4}$ of $\frac{1}{20} = \frac{3}{800} = \frac{3}{1600}$. Facit.
2. Reduce $\frac{1}{8}$ of a pound, to the fraction of a penny.
 $1 \times 20 \times 12 = \frac{240}{8} = 30$ d. Facit.
3. Reduce $\frac{1}{3}$ of an ounce troy, to the fraction of a lb.
Facit..... $\frac{1}{24}$ lb.
4. Reduce $\frac{2}{3}$ of a lb. troy to the fraction of an ounce.
Facit..... $\frac{2}{3}$ oz.
5. Reduce $\frac{1}{24}$ of a lb. avoirdupois to the fraction of an ounce.
Facit..... $\frac{1}{48}$ oz.
6. Reduce $\frac{6}{784}$ of an C. wt. to the fraction of a lb.
Facit..... $\frac{3}{392}$ lb.
7. Reduce $5\frac{1}{2}$ furlongs to the fraction of a mile.
Facit..... $\frac{11}{16}$ Mile.
8. Reduce $\frac{4}{5}$ of an hour to the fraction of a day, also of a week.
Facit..... $\frac{1}{30}$ day, $\frac{1}{15}$ week.

CASE 7.

To reduce a fraction to its value;

RULE.

Multiply the numerator by the parts of the integer, and divide by the denominator; the remainder, multiply by the next lower parts, &c.

EXAMPLES.

1. Reduce $\frac{1}{4}$ of a pound to its value.

2. What is the value of $\frac{1}{4}$ of a shilling?

3. Reduce $\frac{1}{4}$ of a lb. Troy to its value.

4. How much is the $\frac{1}{4}$ of an ell English?

5. What distance is $\frac{1}{4}$ of a mile?

6. What time is the $\frac{1}{4}$ of a day?

7. What is the value of $\frac{1}{4}$ of a dollar?

8. What is the value of $\frac{1}{4}$ of a federal eagle?

9. What quantity is $\frac{1}{4}$ of an acre?

10. Reduce $\frac{1}{4}$ of 72 to its value.

11. What is the value sterling of $\frac{1}{4}$ of an English guinea?

12. What is the value of $\frac{1}{4}$ of an English guinea?

13. What is the value of $\frac{1}{4}$ of an English guinea?

14. What is the value of $\frac{1}{4}$ of an English guinea?

15. What is the value of $\frac{1}{4}$ of an English guinea?

16. What is the value of $\frac{1}{4}$ of an English guinea?

17. What is the value of $\frac{1}{4}$ of an English guinea?

18. What is the value of $\frac{1}{4}$ of an English guinea?

19. What is the value of $\frac{1}{4}$ of an English guinea?

20. What is the value of $\frac{1}{4}$ of an English guinea?

DIVISION OF VULGAR FRACTIONS.

RULE.

Prepare the given fractions, if necessary; invert the divisor, and proceed as in multiplication for the fractional answer.

Abbreviating and cancelling, may also be used in this rule.

EXAMPLES.

1. Divide $51\frac{3}{7}$ by $\frac{2}{3}$ of $\frac{1}{4}$ of 9.

1st. $51\frac{3}{7} = \frac{360}{7}$

2dly. $\frac{2}{3}$ of $\frac{1}{4}$ of 9 = $\frac{2}{3} \times \frac{1}{4} \times 9 = \frac{3}{2}$; inverted, is $\frac{2}{3}$.

Then $\frac{360}{7} \times \frac{2}{3} = \frac{240}{7} = 11\frac{3}{7}$ Facit.

2. Divide $\frac{14}{18}$ by $\frac{7}{16}$. Facit..... $1\frac{1}{3}$.

3. Divide $1\frac{1}{2}$ by $4\frac{1}{2}$. Facit..... $\frac{2}{3}$.

4. Divide $4\frac{1}{2}$ by $\frac{1}{4}$ of 4. Facit..... $2\frac{1}{2}$.

5. Divide $\frac{2}{3}$ of 4 by $4\frac{1}{2}$. Facit..... $\frac{2}{3}$.

6. Divide $\frac{1}{2}$ of 6, by $\frac{1}{3}$ of $\frac{1}{4}$ of $1\frac{1}{2}$. Facit..... $8\frac{1}{2}$.

7. Divide $\frac{1}{2}$ of $\frac{1}{4}$ of $1\frac{1}{2}$, by $\frac{1}{3}$ of 6. Facit..... $\frac{1}{4}$.

8. What is the quotient of $5205\frac{1}{2}$, divided by $\frac{1}{2}$ of 91?

Answer..... $71\frac{1}{2}$.

9. What is the quotient of $4204\frac{1}{2}$ divided by $\frac{1}{2}$ of 112?

Answer..... $42\frac{1}{2}$.

10. If 1794 be divided by $49\frac{1}{2}$, what is the quotient?

Answer..... $36\frac{1}{2}$.

11. A carpet contains 1595 square yards, and is $34\frac{1}{2}$ yards wide; required its length? Yards..... $45\frac{1}{2}$.

12. If $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{1}{4}$ of £.8765 be divided equally among 21 persons, how much is it each?

Answer.....£.104 6 10 $3\frac{1}{4}$.

THE SINGLE RULE OF THREE IN VULGAR FRACTIONS.

RULE.

The operations in the rule of three in vulgar fractions, both single and double, direct and inverse, are the same as the principles laid down in those rules preceding.

Abbreviating, and cancelling, apply in this rule; and also in the double rule of three.

EXAMPLES.

1. If $2\frac{1}{2}$ yards of cloth cost $5\frac{1}{2}$ of a pound; what cost $7\frac{1}{2}$ yards? And what was it a yard?

1st. $2\frac{1}{2} = \frac{5}{2}$ yd. Yd. £. Yd.

2dly. $5\frac{1}{2} = \frac{11}{2}$ £. If $\frac{1}{2} :: \frac{11}{2} :: \frac{11}{5}$ direct,

3dly. $7\frac{1}{2} = \frac{15}{2}$ yd.

$$\frac{5}{2} \times \frac{11}{2} \div \frac{15}{2} = \frac{11}{3} = £.16 \text{ ls. } 5\frac{1}{2}\text{d. Answer.}$$

Yd. £. Yd.

If $\frac{1}{2} :: \frac{11}{2} :: 1$

$$\frac{5}{2} \times \frac{11}{2} \div \frac{11}{2} = \frac{5}{2} = £.2 \text{ 1 s. a yard.}$$

2. How many yards of lining, $\frac{1}{2}$ yard wide, will be sufficient to line $102\frac{1}{2}$ yards of cloth, that is $1\frac{1}{2}$ yard wide?

1st. $102\frac{1}{2} = \frac{205}{2}$ yds. } Yd. Yds. Yd.

2dly. $1\frac{1}{2} = \frac{3}{2}$ yds. } As $\frac{1}{2} :: \frac{205}{2} :: \frac{205}{3}$ inverse.

Answer.....205 yards.

3. If $\frac{3}{4}$ of a yard cost $\frac{7}{12}$ £. what cost $\frac{5}{12}$ of a yard?

Answer.....2s. 4d.

4. What quantity of shalloon, that is $\frac{1}{2}$ of a yard wide, will line $22\frac{1}{2}$ yards of cloth, $1\frac{1}{2}$ yard wide?

Answer.....45 yards.

5. If $\frac{1}{4}$ of an ell English cost $\frac{7}{12}$ £, what is that per ell?

Answer.....18s. $10\frac{2}{3}$ d.

6. When 4 ounces of silver cost $32\frac{1}{2}$ s. what is the value of $\frac{1}{4}$ of an ounce?

Answer.....6s. 1d. $3\frac{1}{2}$ qr.

7. What quantity of Persian $\frac{4}{5}$ yd. wide, will line $6\frac{1}{2}$ yards of white sattin, that is $1\frac{1}{2}$ yd. wide?

Answer.....Yds. 9 3qr.

8. If 16 men can finish a piece of work in $28\frac{1}{2}$ days, the time is required in which 12 men will perform it?

Answer.....Days 37 $\frac{1}{2}$.

9. What sum will pay for 100 yds. of cloth, at $34\frac{2}{3}$ s. a yard?

Answer.....£.172.

Answer.....2 $\frac{1}{2}$ oz.

10. A piece of tapestry 3 ells Flemish wide and 12 long, is to be lined with $\frac{1}{2}$ yd. wide stuff; how many yards are sufficient?

Answer.....27 yards.

11. How many yards of baize ell English wide, are sufficient to line 40 yds. of camblet $\frac{1}{2}$ yd. wide?

Answer.....24 yards.

12. If $\frac{2}{3}$ of an ell English be worth $\frac{2}{3}$ of 19s. what is the value of 21 ells?

Answer.....£.22 3 4.

13. If 16 lb. of tobacco cost 9s. $7\frac{1}{2}$, what is that per lb.?

Answer.....7 $\frac{1}{2}$ d.

14. Sold 8 pieces of cloth, each $27\frac{3}{8}$ yds. at $15s.\frac{1}{4}$ per yard; required the amount?

Answer.....£.171 1 10 $\frac{1}{2}$.

15. Sold $3\frac{1}{2}$ pieces of silk, each $24\frac{1}{2}$ yds. at $12\frac{1}{2}$ s. per yard; what was their value?

Ans.....£.51 9 1 $\frac{1}{2}$.

16. Bartered $5\frac{1}{2}$ C. of sugar, at $6\frac{1}{2}$ d. per lb. for tea at $8\frac{1}{2}$ s. per lb. Query the equivalent quantity of the latter article?

Answer.....lbs.43 $\frac{1}{8}$.

17. If $\frac{1}{3}$ lb. less by $\frac{1}{8}$, cost 2s. $2\frac{3}{4}$ d. what cost 14lb. less by $\frac{1}{3}$ of 2 lb.?

Answer.....£.8 16.

18. K. lends to M. £.100 $\frac{2}{3}$ for $6\frac{2}{3}$ months; what sum ought M. to lend K. for $3\frac{1}{2}$ years, to requite his kindness?

Answer.....£.14 18s. 2d. 1 $\frac{1}{2}$ qr.

19. Bought 120 lb. of tea at $8\frac{1}{2}$ per lb. which being sold for £.70 required the gain per cent?

Answer.....£.35 5s. 3d. $3\frac{5}{8}$ qr.

20. If $3\frac{1}{2}$ yds. cost 1 dol. 20cts. what will purchase $9\frac{1}{2}$ yds.?

Answer.....Ds. 3 41cts. +

21. Sold $1\frac{1}{2}$ yd. for 2 dols. 40 cts. what is the value of $32\frac{1}{2}$ yds. at that rate?

Answer.....Ds. 62 40cts.

22. If when wheat is at $75\frac{1}{2}$ cents a bushel, the half-dime loaf weighs 7 oz. what ought the loaf to weigh, when wheat is at 2 ds. $11\frac{3}{4}$ cents the bushel?

23. If $3\frac{1}{2}$ times $3\frac{1}{2}$ lb. cost 6 dollars; what then is the value of $\frac{1}{2}$ of $\frac{1}{2}$ of $\frac{1}{2}$ of $12\frac{1}{4}$ lb.? Ans.....50 cents.

24. A person having $\frac{4}{5}$ of a ship, sells $\frac{3}{4}$ of his share for 850 $\frac{2}{3}$ dollars; what is the worth of the whole vessel at that rate? Answer.....Dols. 1595.

25. If $3\frac{1}{2}$ cwt. of tea, at $1\frac{3}{4}$ of a dollar per lb. be bartered for coffee, at $\frac{1}{4}$ of a dollar per lb. what quantity of the latter article will be equivalent?

-Answer.....Cwt. 26 $\frac{1}{4}$.

THE DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

EXAMPLES.

1. If $2\frac{1}{4}$ yards of cloth, that is $1\frac{3}{4}$ yd. wide, cost $3\frac{3}{4}$ £. what is the value of $38\frac{1}{4}$ yds. that is 2 yards wide?

1st. $2\frac{1}{4} = \frac{9}{4}$ yd. If $\frac{9}{4}$ yd. } $1\frac{3}{4}$ £. { $1\frac{3}{4}$ yd. direct.
2ndly. $1\frac{3}{4} = \frac{5}{2}$ yd. $\frac{5}{2}$ yd. } $\frac{1}{2}$ £. { $\frac{1}{2}$ yd. direct.

3rdly. $3\frac{3}{4} = \frac{15}{4}$ £.

4thly. $38\frac{1}{4} = \frac{153}{4}$ yd.

$$\frac{4}{9} \times \frac{5}{15} \times \frac{15}{4} \times \frac{153}{4} \times \frac{1}{5} = \frac{106}{4} = \text{£.} 76 \text{ 10s. Ans.}$$

2. If 4 men have £. 22 $\frac{1}{2}$ for 3 days work, how many men will earn £. 93 $\frac{3}{4}$ in 16 days?

1st. $22\frac{1}{2} = \frac{45}{2}$ £. If $\frac{45}{2}$ d. } $\frac{16}{3}$ d. inverse.

2dly. $93\frac{3}{4} = \frac{48}{1}$ £. $\frac{48}{1}$ £. } $\frac{4}{1}$ m. { $\frac{48}{1}$ £. direct.

Answer.....3 men.

3. If 3 men receive 8 $\frac{2}{5}$ £. for 19 $\frac{1}{2}$ days labour; how much must 20 men have for 100 $\frac{1}{4}$ days?—Direct.

Answer.....£. 305 0 8 $\frac{2}{5}$.

4. If 16 $\frac{1}{2}$ s. be the portage of $5\frac{1}{4}$ cwt. for 20 miles, what must be paid for the carriage of $17\frac{3}{4}$ cwt. 7 $\frac{1}{2}$ miles?

Answer.....20s. 8 $\frac{1}{2}$ d.

5. If 5 persons drink 7 $\frac{4}{5}$ gallons of beer in a week, what quantity will serve 8 persons 22 $\frac{1}{2}$ weeks?

Answer.....Gals. 280 $\frac{1}{4}$.

6. If $13\frac{1}{3}\text{£}$. in $\frac{3}{4}$ of a year, gain $1\frac{1}{12}\text{£}$. interest, what interest will 50£ . gain in $\frac{1}{4}$ of a year?

Answer..... $\text{£} 3\ 5\ 1\ 2\frac{1}{2}\text{qr}$.

7. When 12 persons use $1\frac{1}{2}\text{lb}$ of tea per month, how much should a family of 8 persons provide for $1\frac{1}{2}$ year?

Answer..... $\text{lb. } 13\frac{1}{2}$.

8. What principal at $3\frac{1}{2}$ per cent. will clear $38\frac{1}{2}\text{£}$. in $1\frac{1}{4}$ year?

Answer..... $\text{£} 880$.

9. Two brothers at school compute their expense for $\frac{2}{3}$ of a year to be 150 dollars; how much will the education, &c. of three sons for $5\frac{1}{2}$ years, cost their father, at that rate?

Answer.....Dols. 1650.

10. If $3\frac{3}{4}$ yds. of cloth, that is $1\frac{1}{2}$ yard wide, cost 44 dollars, what, of like quality, is the value of $7\frac{1}{4}$ yards, that is $1\frac{1}{2}$ yard wide?

Answer.....Dols. 14 40cts.

DECIMAL FRACTIONS.

A decimal fraction is a part, or parts of an integer, denoted by the numerator, with a point prefixed; the denominator being conceived to be divided into 10, 100, 1000, &c. equal parts; the decimals consisting of as many of those parts as is expressed by the numerators. Thus, $.5 = \frac{5}{10}$; $45.56 = 45\frac{56}{100}$, &c.

As whole numbers, counted from right to left, increase in a tenfold proportion; so decimals, reckoned from left to right, decrease in the like proportion. Thus, $.5 = \frac{5}{10}$; $.05 = \frac{5}{100}$; $.005 = \frac{5}{1000}$; &c.

TABLE.

C. of Millions.	X. of Millions.	Millions.	C. of Thousands.	X. of Thousands.	Thousands.	Hundreds.	Tens.	Units.	Tenth parts.	Hundredth parts.	Thousandth parts.	Thousandth parts.	Thousandth parts.	Millionth parts.	Millionth parts.	Millionth parts.	Millionth parts.	
9	8	7	6	5	4	3	2	1	.	1	2	3	4	5	6	7	8	9

ADDITION OF DECIMALS.

RULE.

Let the decimal points, in the given numbers, be directly under each other;—add as in integers; and let the points in the sum total, range with those in the example.

EXAMPLES.

Yards.	£.
27.463	276.2
72.537	75.36
69.825	82.07
30.175	9.7065
67.461	25.3
84.789	487.
<hr/> 352.250 = 352 $\frac{25}{100}$	<hr/> 955.6365 = 955 $\frac{6365}{10000}$

1. What is the sum of $429 + 21.37 + 355.003 + 1.07 + 1.7$? Answer.....808.143.

2. Required the sum of $973 + 19 + 1.75 + 93.7164 + .9501$? Sum 1088.4165.

3. Sent to Bank, viz. Dols. 3476.57 cts. Dols. 286.95 cts. Dols. 1090.56 cts. Dols. 187.25 cts. and Dols. 88.42 cts. Query the sum of these deposits?

Answer.....Dols. 5129.75.

4. A person left his widow Dols. 5756.75 cts; his son Dols. 4685.86; to two daughters, each Dols. 3846.94 cts. to a niece, Dols. 3000; and for charitable uses, Dols. 1875.80 cts. what is the sum of these bequests?

Answer.....Dols. 23012.29.

SUBTRACTION OF DECIMALS.

RULE.

Let the decimal points, in the given numbers, be directly one under the other; subtract as in integers; and let the point, in the difference, range with those in the example.

EXAMPLES.

	Yards.	Gallons.	Dols. cts.
From	271.435	278.41	289.1
Take	180.289	198.076	1.875
	<hr/>	<hr/>	<hr/>
Rem'd.	91.146		
	<hr/>	<hr/>	<hr/>
Proof.	271.435		
	<hr/>	<hr/>	<hr/>

1. What is the difference between 1004.2176, and 893.9? Answer.....110.3176.

2. What is the difference between the sum of 467.625 + 287. + 109.375, and of 376.987 + 298.789 + 78.024 + 3.211? Answer.....106.989.

3. Borrowed 1000 dollars, paid 887 dols. 56 cts. what sum is yet unpaid? Answer.....Dols.112.44.

4. Deposited in Bank, viz. Dols.408.46 + Dols.590.28 + Dols.365.87. Drew checks as follow, viz. Dols.370.45 + Dols.598.27 + Dols. 192 + Dols. 98.64. Query the balance on the check book?

Answer.....Dols.105.25 cents.

MULTIPLICATION OF DECIMALS.

RULE.

Place the figures, and multiply as in whole numbers, separating as many decimals to the right of the product, as there are in both the factors. If decimal places be wanting in the product, prefix ciphers.

In contractions:

Reverse the multiplier, and set the unit figure thereof under that figure of the multiplicand to be retained in the product. Multiply the first figure to the right of each multiplier, carrying one for five, two for fifteen, three for twenty-five, &c. adding them into the product of that which is directly over the multiplier, setting the first figure of each product column-wise: The sum total will be the product sought.

EXAMPLES.

1. Multiply 79.3475 by 23.15.

79.3475 Contracted, and to retain two decimals.
23.15

$$\begin{array}{r}
 79.3475 \\
 \times 23.15 \\
 \hline
 3967375 \\
 793475 \\
 2380425 \\
 1586950 \\
 \hline
 1836.894625 \text{ Facit.}
 \end{array}$$

$$\begin{array}{r}
 79.3475 \\
 \times 51.32 \\
 \hline
 158695 \\
 23804 \\
 793 \\
 397 \\
 \hline
 1836.89 \text{ Facit.}
 \end{array}$$

2. Multiply .63478 by .8264. Facit..... .52458219.

3. Multiply .385746 by .00463. Facit. .0017860039.

4. Multiply 3.141592 by 52.7438.

Facit.....165.6995001296.

5. Multiply the last example, and retain three places of decimals in the product. Facit.....165.699.

6. Multiply 56.753491 by 5.376928. retaining five places of decimals. Facit.....305.15943.

7. Multiply 492.64 by 72.62. retaining only the integers. Facit.....35775.

DIVISION OF DECIMALS.

RULE.

Divide as in whole numbers, separating in the quotient as many decimal places, as, with those in the divisor, will equal the decimal places in the dividend.

A deficiency of decimal places in the quotient, must be supplied by prefixing ciphers.

When the decimal places in the divisor and dividend are equal, the quotient will be whole numbers.

In contractions :

Consider what figure of the dividend corresponds with the units figure of the divisor ; the same place must the first figure of the quotient have. In dividing, reject the last right-hand figure of the divisor at every step, instead of bringing down a figure (first multiplying it, and car-

rying as in contracted multiplication), and make the last remainder the dividend for the diminished divisor at every step: thus continue the division to the highest figure of the divisor.

EXAMPLES.

1. Divide 15080.335650 by 642.975.

642.975)15080.335650(23.454 Facit.

1285950

Contracted.

6,4,2,9,7,5)15080.33565(23.454

2220835

128595

1928925

22208

2919106

19289

2571900

2919

3472065

2572

3214875

347

2571900

321

2571900

26

0

26

0

2. Divide 8673.7661 by 46.85 Facit.....79.347..

3. Divide 469.4105 by 128.5. Facit.....3.653..

4. Divide 165.6995001296 by 3.141592..

Facit.....52.7438..

5. Divide 165.6995001296 by 52.7438. by contraction, retaining 4 decimals in the quotient. Facit.....3.1416..

6. Divide 007.14401592 by .771492. Facit.....00925..

7. Divide 348.3 by 18.73086. retaining 3 places of decimals in the quotient. Facit......18.595..

* Here 3, the ten's place of the dividend, will occupy the unit's place of the divisor; consequently the quotient will consist of two whole numbers.

REDUCTION OF DECIMALS.

CASE I.

To reduce a vulgar fraction to a decimal ;

RULE.

Add ciphers to the numerator, and divide by the denominator, prefixing ciphers to the quotient, when the rule in division requires it.

If a compound fraction be given, first reduce it to a single one.

EXAMPLES.

1. Reduce $\frac{1}{8}$ to a decimal.

$$8 \overline{) 1.000}$$

.125 Facit.

2. Reduce $\frac{1}{6}$ to a decimal. Facit..... .1923

3. Reduce $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ to decimals, and give their sum.
Facit..... .25, .5, .75 ; Sum 1.5.

4. Reduce $\frac{1}{4}$ of $\frac{1}{2}$ of $\frac{7}{8}$ to a decimal.
Facit..... .109375

5. What is the equivalent decimals and sum of $\frac{1}{10}$, $\frac{2}{10}$, $\frac{3}{10}$, $\frac{4}{10}$ and $\frac{5}{10}$?
Answer..... .55, .65, .375, .875, .0546875 ; Sum 2.8046875.

6. What is the difference, and what the sum of $\frac{3}{4}$ and $\frac{1}{2}$?
Diff. .025, Sum 1.225.

CASE II.

To reduce money, weight, or measure, to their equivalent decimal values ;

RULE.

Set down the lowest name, then the next, &c. columnwise, and divide each by the next higher denomination ; the last quotient will be the decimal sought. Or, :

Divide the sum given, in its lowest name, by the number of such parts as are in the integer.

By inspection :

Set down half the even number of shillings for the first decimal figure, and if the shillings be odd, let 5 possess the second place. Let the farthings in the pence and farthings possess the second and third places, increasing the third place by 1, if they exceed 12, and by 2, when they are above 36.

EXAMPLES.

1. Reduce 17s. $8\frac{1}{4}$ to the decimal of a Pound.

4	1.	17s. $8\frac{1}{4}$ = 849 qrs.
12	8.25	20s. = 960
20	17.6375	849.00(.884375 £. 768 0

Facit. .884375 £.

8100, &c.

By Inspection.

s. d.

17 $8\frac{1}{4}$

85

34

.884 £.

2. Reduce 3 qrs. 12 lb. 6oz. 14.592 dr. to the decimal of an C. wt. Facit..... .861 C. wt.

3. Reduce 1, 2, and 3 farthings, to the decimals of a penny. Facit..... 1qr. = .25d. 2qrs. = .5d. 3qrs. = .75d.

4. Reduce 3d. 6d. and 9d. to the decimals of a shilling, and tell the sum.

Facit..... 3d. = .25s. 6d. = .5s. 9d. = .75s.

Sum..... 1.5s. = 1s. 6d.

5. Reduce 1s. 8s. 15s. and 19s, to the decimals of a pound, and tell their sum.

Facit..... 1s. = .05 £. 8s. = .4 £. 15s. = .75 £. 19s. = .95 £.

Sum..... £. 2.15 = £. 2 3s.

6. Reduce 5 £. 13s. 5d. $\frac{1}{4}$ to a decimal.

Facit..... £. 5.6729 +

7. Reduce 10oz. 13dwt. 9gr. to the decimal of a pound troy.

Facit..... .8890625 lb.

8. Reduce 3qr. 3 na. to the decimal of a yard.

Facit..... $.9\frac{1}{2}$ yd.

9. Reduce 13A. 1R. 14per. to a decimal.

Facit..... 13.3375A.

10. Reduce 3mo. 1w. 5da. to a decimal.

Facit..... 3.42857 mo. $\frac{1}{7}$

11. What is the decimal of £.520 18s. 7 $\frac{1}{2}$ d.?

Answer..... £.520.93125.

12. What is the decimal of £.101 10 3 $\frac{1}{4}$?

Answer..... £.101.51458. $\frac{1}{8}$

CASE 3.

To find the value of a decimal fraction;

RULE.

Multiply it by the parts of the integer, separating to the right as many decimal places, as there are in the given number.

By inspection :

Double the first figure for shillings ; and, if the second be 5, or more, add another shilling. Then, the second figure, if less than 5, or its excess above 5, with the figure in the third place, call farthings ; abating 1, if more than 12, and 2, when above 36.

EXAMPLES.

1. What is the value of .884375 of a pound?

.884375

20

a. 17.687500

12

d. 8.2500

4

qr. 1.00 Answer..... 17s. 8 $\frac{1}{2}$ d.

By inspection.

.88 = 17s. $\frac{1}{2}$ 3

34 qr. = 8 $\frac{1}{2}$

17s. 8 $\frac{1}{2}$ as before.

2. What is the value of .675 of a shilling.

Answer..... $8\frac{1}{16}$ d.

3. What is the value of .99999 of a Pound.
Answer.....19s. 11d. 3³²/₁₀₀q.
4. What is the value of .83229 of a £? find it also by inspection.
Answer.....16s. 7d. 2.9984q.
... by inspec. 16s. 7d. 3q.
5. What is the value of .7 of a lb. Troy?
Answer.....8oz. 8dwt.
6. What is the value of .861 of an C. weight?
Answer.....3qr. 12lb. 6oz. 14.592dr.
7. What is the value of .4712 of an ell English.
Answer.....2qr. 1.424na.
8. How much is 7.875 acres of land?
Answer.....7A. 3R. 20Per.
9. How much is the .6875 of a yard of cloth?
Answer.....2qr. 3na.
10. Find the value of .7865 of a £. by inspection.
Facit.....15s. 8d. 3qr.
11. What is the sum of .48 of a £. and .16 of a shilling?
Answer.....9s. 2.12d.
12. What is the difference between .17£. and .7s.?
Answer.....2s. 8d. 1.6qr.
13. Sold 25 yards of. cloth at 2.75£. per yard; what was its value?
Answer.....68£. 15s.
14. A tenement was let for 7 years, at 25.7£. a year; received rent 84.65£.; what is remaining?
Answer.....95£. 5s.
15. Tell the sum of the following decimals by inspection. viz. .785£. + .537£. + .916£. + .74£. + .5£. + .25£. + .09£. + .008£.
Facit.....3£. 16s. 6d.
16. From .5 of an eagle, take .8 of a dollar and 55 cents, and tell the remainder?
Answer.....3Del. 65Cents.

THE SINGLE RULE OF THREE IN DECIMALS.

RULE.

The operations in the Rule of Three in Decimal Fractions, both single and double, direct and inverse, are the same as the operations of the principles laid down in those

rules preceding; regard being had to the placing of the decimal point.

Abbreviating, and cancelling, often usefully apply.

EXAMPLES.

1. If 2.8 yards of cloth cost £5.8333, what cost 7.7143 yards? See Vul. Frac. Direct Prop. Ex. 1.

Yds. £. Yds.
If 2.8—5.8333—7.7143 } Multiply.
5.8333 }

2.8)44.99982(16.0713=
28
— £.16 1 5+ Answer.
169, &c. —

2. At 4.5 £. for 1.5 cwt. of sugar, what is that for 27.2 cwt.?

C. £. C.
If 1.5—4.5—27.2
— 3
3. — £. s.
£.81.6=81 12 Answer.

3. How many men can do as much work in .4 of a month, as 16 men have done in 1.5 month?

Mo. Men. M.
As 1.5—16.0—4 inverse.
40 —

Men. 60.0 Answer.

4. If 3.5 times 3.5lb. cost 1.5 times 1.5 £. what is the value of .5 X .5 X 12.25lb? Answer.....11s. 3d.

5. If 1.4 lb. of nutmegs cost 43.5s. what cost 75.3lb? Answer.....116£. 19s. 11d. 3.04qr.

6. A board is .75 of a foot broad; what length must be taken, to contain 24 square feet?

Answer.....32feet.

7. If 1.47 cwt. of sugar be worth £.4.5; what is that for 3.4lb? Answer.....1s. 10d. 1.2qr.

8. How much persian $\frac{1}{4}$ yard wide, will line 76.5 yards of five quarter cloth? Answer.....127.5yds.

9. A had 40.7 yards of linen, for which B gave him 25.6 ells of holland, valued at 15.5s. per ell; how was A's linen rated per yard? Answer.....8s. 5d. 3.5qr. +

10. Bought 436 yards of hair-bine, at 8.5s. the yard, which being disposed of at 10.75s. per yard; query the gain? Answer.....49£. 1s.

11. P. owes Q. 593.7£. but compounds for 7.5s. in the pound; what sum must Q. receive?

Answer.....222£. 12s. 9d.

12. At 4.5 cents the yard, what is the value of 690 yards? Answer.....31.05dols.

13. Sold 1350 yards of riband for 25dols. 65cts. what was that for 10 yards; and what per yard?

Answer.....19 cents. and 1 ct. 1 m. per yard.

14. If 9.5 yards of cloth cost 25dols. 75cts. what will 217.75 yards come to? Answer.....590dol. ct. 21 +

15. What is the value of $14\frac{1}{2}$ of broad cloth, at 5dol. 50cts. per yard? Answer.....81dol. $12\frac{1}{2}$ cents.

16. How many dollars at 7.5s. are equal to 500 French guineas at s.34.5? Answer.....2300 dol.

17. What money has A. at interest, to yield as much in 7.5 months, as B's 1200dols. does in 22.5 months?

Answer.....3600dols.

THE DOUBLE RULE OF THREE IN DECIMALS.

EXAMPLES.

1. Two brothers at school, compute their expense for .75 of a year to be £.56.25; how much will the education of 3 sons, for 5.5 years, cost their father at that rate?

—Direct proportion.

If 1 per. }	£.	{ 3 per.	
.75 yr. }	56.25	{ 5.5 yr.	
	228.		
	112.5 }	multiply.	
	5.5 }		

£.618.75 = £.618 15 Answer.

2. How many men will reap 417.6 acres in 14 days, when 5 persons cut 52.2 acres in half the time?—

Inverse proportion. Answer.....20 Men.

3. If the interest of £.76.5 for 9.5 months be £.15.24 what principal will gain £.6 in 12.75 months?

£.22 8 9½ +

4. What principal at 3½ per cent per annum will clear £.58.5 in a year and a quarter? £.880.-

5. If 32s. 8d. pay for the carriage of 10.5 C. wt. 20 miles, what must be paid for carrying 17.75 C wt. 7.5 miles? £.1. 0 8½.

6. If 4 men have £.2.4 for 3 day's labour; how many men will earn £.9.6 in 16 days? 3 Men.

7. If a cellar 22.5 feet long, 17.3 wide, and 10.25 deep, be dug in 2.5 days, by 6 men, working 12.3 hours a day; how many days, of 8.2 hours, should 9 men take to dig another, measuring 45. by 34.6 by 12.3 feet?

12 Days.

8. If 5 persons receive £.28. 5 for 9.5 days labour; what must 20 men and 10 boys have, for 24½ days; two boys being equal to one man? Answer.....£.368 15.

ALLIGATION.

ALLIGATION is a rule for solving questions, wherein the mixing of divers simples is considered.

CASE 1.

When the quantities, and their prices are given, to find the price of a part of the composition;

RULE.

The value of the given quantities, divided by their sum, will be the answer.

PROOF.

The value of the whole composition, at the mean price, will equal the value of the given quantities, at their respective rates.

EXAMPLES.

1. If 3 gallons of wine at 4s. per gallon, 3 at 5s. 6 at 5s. 6d. and 6 at 6s. per gallon, be mixed together, what is the value of 1 gallon of this mixture?

$$\left. \begin{array}{rcl} 3 \times 4 & = & 12 \\ 3 \times 5 & = & 15 \\ 6 \times 5 & 6 = & 33 \\ 6 \times 6 & = & 36 \end{array} \right\} = \text{£.4 16s. 5s. } \frac{1}{2} \text{) 18 at 5s. 4d.}$$

$$\begin{array}{r} \text{—} \\ 18 \end{array} \quad \begin{array}{r} \text{—s. d.} \\) 96(3 \ 4 \text{ Answer.} \\ 90 \\ \text{—} \end{array}$$

$$\begin{array}{r} 4\text{d. } \frac{1}{2} \text{) } 4 \ 10 \\ \underline{0 \ 6} \\ \text{£.4 16 Proof.} \\ \text{—} \end{array}$$

6 &c.

2. A grocer mixed 15lb. of tea, at 84cts. per lb. with 27lb. at 1dol. 13cts. and 43lb. at 78cts. what is the value of 6lb. of this mixture? Answer.....5dols. 40cts. +

3. A refiner melted 5lb. of silver bullion of 8oz. fine, with 10lb. of 7oz. fine, and 15lb. of oz. 6; of what fineness is the mass? Answer.....6oz. 13dwt. 8gr.

CASE 2.

When the rates of several simples are given, to find how much of each must be taken to bear a proposed price;

RULE.

Set the given rates under each other, alike in denomination, and link them so, that one less than the mean rate be joined to one that is greater. The difference between each price, and the mean rate, place alternately for the answer.

Different ways of linking in the several cases, will produce different answers. The following example may be linked seven ways; consequently will produce seven different answers.

EXAMPLES.

1. How many gallons of wine at 4s. 5s. 5s. 6d. and 6s. per gallon, must be taken, to be sold at 5s. 4d. per gallon, so as to sustain no loss?

$$\begin{array}{l} \text{Mean rate 64} \end{array} \left\{ \begin{array}{l} 48 \\ 60 \\ 66 \\ 72 \end{array} \right\} \begin{array}{l} 2+8=10 \text{ at 4s.} \\ 2+8=10 \quad 5s. \\ 16+4=20 \quad 5s. 6d. \\ 16+4=20 \quad 6s. \end{array} \right\} \text{Ans.}$$

2. A grocer has tea at 12s. 11s. 9s. and 8s. per lb. how much of each must he take, to average 10s. per lb.

Answer.....3lb. of each.

3. It is required, to mix wines at 3s. 5s. and 7s. per gallon, with water, that it may be worth 4s. per gallon; the quantity of each is required?

Answer..... $\left\{ \begin{array}{l} 1 \text{ gal. at } 3\text{s. } 1 \text{ at } 5\text{s. } 4 \text{ at } 7\text{s.} \\ \text{and } 3 \text{ of water,} \end{array} \right.$

CASE 3.

When the price of the simples, the quantity of one of them, and the mean rate if the whole are given, to find the other quantities;

RULE.

Link, and take the differences, as in case 2. Then,
As the difference of the name with the given quantity,
Is to the given quantity;
So is the differences respectively,
To the quantities required.

EXAMPLES.

1. How much wine at 4s. 5s. and 5s. 6d. per gallon, must be mixed with 10 gallons, at 6s. that the whole may be worth 5s. 4d. per gallon? G. s. d.

64 $\left\{ \begin{array}{l} 48 \quad 2 + 8 = 10 \text{ As } 20 \dots 10 :: 10 \text{ to } 5 \text{ at } 4 \ 0 \\ 60 \quad 2 + 8 = 10 \quad \quad \quad 5 \text{ at } 5 \ 0 \\ 66 \quad 16 + 4 = 20 \quad 20 \dots 10 :: 20 \text{ to } 10 \text{ at } 5 \ 6 \\ 72 \quad 16 + 4 = 20 \end{array} \right\} \text{Ans.}$

2. How much barley at 2s. 6d. rye at 3s. and wheat at 4s. per bushel, must be mixed with 12 bushels of oats at 18d. per bushel, that the whole may rate at 1s. 10d. per bushel? Answer.....1bush. of each.

3. A merchant has a chest of tea, weight 84lb. at 6s. per lb. which he would mix with some at 4s. 6d. 5s. 2d. and 5s. 7d. per lb.; what quantity of these must he take, that he may sell the whole at 5s. 9d. per lb.?

Answer.....10lb. 8oz. of each.

CASE 4.

When the rates of the simples, the quantity, and the mean rate thereof are given, to find each simple ;

RULE.

Link, and take the differences as before ;

As the sum of the differences,

Is to the quantity given ;

So is each particular difference,

To the quantity required.

EXAMPLES.

1. How much wine at 4s. 5s. 5s. 6d. and 6s. per gallon, must be taken to make a mixture of 18 gallons, worth 5s. 4d. per gallon ?

			G.	G.	G.	G.	
			As	60	..	18 ::	10 to 3 at 4s.
							and 3 at 5s.
							60 .. 18 :: 20 to 6 at 5s. 6
							and 6 at 6s.

64	{	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> 4s 60 66 72 </div> <div style="font-size: 3em;">}</div> <div style="margin-left: 10px;"> 2 + 8 = 10 2 + 8 = 10 16 + 4 = 20 16 + 4 = 20 <hr/>60 </div> </div>	} Ans.
----	---	--	--------

2. How many gallons of water must be mixed with wine at 4s. per gallon, so as to fill a vessel of 80 gallons, that may be afforded at 2s. 9d. per gallon ?

Answer..... { 25 gal. water.
55 wine.

3. A grocer has 4 sorts of coffee, at 8d. 12d. 18d. and 22d. per lb. the worst will not sell; and the best is too dear; what quantity of each must he take, to make 120lb, so as to be sold at 16d. per lb. ?

Answer..... { 36lb. at 8d. 12 at 12d. 24 at 18d.
and 48 at 22d.

POSITION.

POSITION is a rule for solving questions, by making use of one or two supposed numbers; and is either Single or Double.

SINGLE POSITION.

When the question can be wrought by one supposition;

RULE.

Suppose a number, which, agreeably to the tenor of the question, will divide evenly, and proceed as if it were the true number. Then,

As the result,

Is to the supposed number ;

So is the number in the question,

To the answer, or part of it.

If more answers than one be required, proceed with the first answer, as with the supposition, for obtaining the others.*

PROOF.

The sum of the answers generally equals the given sum : But, some times, the product depends otherwise, according to the tenor of the question.

EXAMPLES.

1. What sum is that, of which the $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ make 222*£*.?

Suppose *£*.60

As $\frac{\text{£.}}{37} \cdot \frac{\text{£.}}{60} :: \frac{\text{£.}}{222}$

$\frac{1}{2}$	15
$\frac{1}{3}$	12
$\frac{1}{4}$	10

Result 37

60	
<hr/>	
37)	13320 (360 Ans.
	111
	<hr/>
	$\frac{1}{2}$ 90
	222 $\frac{1}{3}$ 72
	222 $\frac{1}{4}$ 60
	<hr/>
	00 222 <i>£</i> . Proof.

2. A person having a certain number of guineas, said, $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ of them would make 114 ; how many had he ?
Answer.....120.

* To know whether the question belongs to single or double position; Suppose two numbers, and proceed as the rule directs: If the errors, when multiplied by their reverse supposed numbers, give equal products, the question belongs to Single Position; otherwise not.

3. B's age is $1\frac{1}{2}$ A's ; C's twice B's ; both with A's make 132 years ; how old is each of them ?

Answer.....A 24, B 36, C 72 years.

4. A schoolmaster being asked, how many scholars he had, answered, if to double the number, I add $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ of them, I shall have 333 ; how many had he ?

Answer.....108.

5. What sum of money, at 6 per cent per annum, simple interest, will amount to 1000*£*. in 10 years ?

Answer.....625*£*.

6. What number of acres ; in a square form, must there be, that the acres inclosed shall equal the rails to fence it ; the height of the fence to be seven rails, and two pannels to every rod ?

Suppose 1 mile square :

1 mile = 320 perches. Then, $320 \times 320 = 640$ acres.

And, $320 \times 4 \times 2 \times 7 = 17920$ rails.

As $640 :: 17920 :: 17920 :: 501760$ rails ; which will inclose 501760 acres = 28 miles square.

DOUBLE POSITION.

When the nature of the question requires two suppositions ;

RULE.

Suppose two numbers, and proceed agreeably to the tenor of the question, noting the errors. Then, multiply the first number by the last error ; and the last number by the first. If the errors be both greater, or both less than the given number, take their difference for a divisor, and the difference of the above products for a dividend. If one error be greater, and the other less, take their sum for a divisor, and the sum of the products for a dividend ; the quotient will be the answer, or part of it ; from which the others, if others be required, may be obtained.

Sometimes 0 and 1 may be the suppositions ; then the first error, divided by the difference of the errors, will give the answer..

EXAMPLES.

1. A, B, and C, would divide 100*£*. between them, so as that B may have 3*£*. more than A, and C 4*£*. more than B ; What was the share of each ?

Suppose A 10£.	Sup. A 12£.	Pos.	Er.	
B 13	B 15	10	60	} 6 dif.
C 17	C 19	12	54	
— Er.	— Er.	—	—	
£.100—40=60	100—46=54	720	540	
		540		
		—		
		6)180		
		—		
		A.....30		} Answer.
		B.....33		
		C.....37		
		—		
		£.100 Proof.		

Or thus :

Suppose A 0	Sup. A 1	
B 3	B 4	
C 7	C 8	
—	—	90
100—10=90	100—13=87	} Errors.
3)—	—	
		3 diff.
Ans. { A.....30.		
B.....33		
C.....37		
—		
£.100 proof.		

2. Of 1000£. expenditure, B paid 100£. more than A, and C paid as much as both A and B: Each man's part is required ;

Answer.....A200£. B300£. C500£.

3. What number is that, which being increased by its $\frac{1}{2}$ and its $\frac{1}{4}$, and 5 more, will be doubled?

Answer.....20.

4. Bought linens at 4s. per yard, and at 2s. per yard; the number of yards were 8, and the whole price 20s. how many yards of each were there?

Answer.....2yds. at 4s. and 6 at 2s.

5. Bought 15 yards for £.3 10s. viz. damask at 8s. per yard, and lining for it at 3s. per yard; Query the number of yards of each?

Answer.....5yds. damask, 10 do. lining.

6. The head of a fish is 9 inches long, and its tail is as long as its head, and half the body, and the body is equal to both the head and tail : The length of it is required ?

Answer.....6feet.

7. A is 20 years of age, B's age is A's and half C's, and C's equals them both : Their several ages are required ?

Answer.....A20, B60, C80years.

8. A person being asked the hour of the day, said, the time past noon is equal to $\frac{4}{5}$ of the time till midnight : what was the hour ?

Answer.....20min. past 5.

9. Two persons have each an equal income ; M saves $\frac{1}{5}$ of his money yearly ; but N, by spending 150 dollars per annum more than M, at the end of eight years finds himself 400 dollars in debt ; what is their income, and what does each man spend per annum ?

Ans..... $\left\{ \begin{array}{l} \text{Income 500 dols. per annum.} \\ \text{M spends 400, and N 550 dols. per ann.} \end{array} \right.$

PERMUTATION.

Permutation is a rule for finding how many changes any given number of things are liable to undergo. Thus, lmn, may be set 6 different ways ; as, lmn, lnm, mln, mnl, nml, nlm.

RULE.

Multiply continually, all the numbers given, for the answer.

EXAMPLES.

1. In how many different positions may 1, 2, 3, 4, 5, 6, be placed ? $1 \times 2 \times 3 \times 4 \times 5 \times 6 = 720$ Answer.

2. In how many different positions could 12 persons seat themselves at dinner, and for what length of time ?

Positions.....479001600.

Years..... 1311434.+

3. What number of variations will the 26 letters of the alphabet admit of ?

Answer.....403291461126605635584000000.

INVOLUTION.

INVOLUTION, or the raising of powers, is the product of a continual multiplication of a given number, by itself, a certain number of times.

Thus, $2 \times 2 = 4$; the second power, or square of 2.

$3 \times 3 \times 3 = 27$; the third power, or cube of 3.

$4 \times 4 \times 4 \times 4 = 256$; the 4th power of 4.

$9 \times 9 \times 9 \times 9 \times 9 = 531441$; the 6th power of 9; &c.

The number denoting the power, is called the index; or exponent of that power; and, if two or more powers be multiplied together, the product is that power whose index is the sum of of the exponents of the factors.

Thus, $9 \times 9 = 81$; the 2nd. power, or square of 9.

$81 \times 81 = 6516$; the 4th power of 9.

$6516 \times 6516 = 43046721$; the 8th power of 9; which is equal to $9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 = 43046721$.

EVOLUTION.

EVOLUTION or the extracting of roots, is the finding such a root of a given number, as, being involved equal to the index of the power, will produce the given number. Thus, 4; the square root of which number is 2.

27; the cube root of which is 3.

256; the 4th power of 4.

43046721; the 8th power of 9.

THE SQUARE ROOT.

EXTRACTION of the square root is, the finding a number, which multiplied by itself (or squared) will produce the number given.

RULE.

1. Point the given number both ways into periods of two figures each, beginning with the unit figure, adding a cipher to the decimal, if necessary; which points will denote the number of figures the root will consist of.

2. Find the greatest root of the highest period; the square of which subtract therefrom, and to the remainder bring down the next period for a dividend.

3. Take double the root for a divisor, and see how often it is contained in the dividend (exclusive of the right hand figure;) place the number in the root, and also to the right of the divisor. Multiply and subtract as in division; and so proceed, doubling the whole of the root every time for a new divisor.

When one more than half the figures in the root is obtained, the rest may be found by working as in contracted division of decimals. The root of the following example is extended by contraction four places farther than is indicated by the points.

If a fraction be given, reduce it to its lowest terms: If a surd,* to its equivalent decimal; if a mixt number, reduce it to an improper fraction, or a decimal; and then extract the root as above.

Of a right angled triangle:

The square root of the sum of the squares of the shortest sides, will be the longest side. And, from the square of the longest side, subtract the square of either of the other; the root of the remainder will be the other side.

PROOF.

Involve the root to the second power, adding to the product the remainder, if any.

* A number whose root can never be exactly found, is called a surd.

EXAMPLES.

1. What is the square root of 148.76235?

$$\begin{array}{r} 12.196 \\ 148.762350 \end{array} (12.196, 8174 \text{ Answer.}$$

$$\begin{array}{r} 1 \\ \hline \end{array}$$

$$\begin{array}{r} 22)48 \\ \hline \end{array}$$

$$44 \quad 12.196 \times 12.196 + 19934 = 148.76235 \text{ Pr.}$$

$$\begin{array}{r} 241)476 \\ \hline \end{array}$$

$$\begin{array}{r} 241 \\ \hline \end{array}$$

$$\begin{array}{r} 2429)23523 \\ \hline \end{array}$$

$$\begin{array}{r} 21861 \\ \hline \end{array}$$

$$\begin{array}{r} 24286)166250 \\ \hline \end{array}$$

$$\begin{array}{r} 146316 \\ \hline \end{array}$$

$$\begin{array}{r} 2,4,3,8,6)19934(8174 \\ \hline \end{array}$$

$$\begin{array}{r} 19509 \\ \hline \end{array}$$

$$\begin{array}{r} 425 \\ \hline \end{array}$$

$$\begin{array}{r} 244 \\ \hline \end{array}$$

$$\begin{array}{r} 181 \\ \hline \end{array}$$

$$\begin{array}{r} 170 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ \hline \end{array}$$

$$\begin{array}{r} 1 \\ \hline \end{array}$$

2. What is the square root of 30138696025?

$$\text{Answer.....}173605.$$

3. What is the square root of 575.5

$$\text{Answer.....}23.989 +$$

4. What is the square root of 10342656?

$$\text{Answer.....}3216.$$

5. What is the square root of 234.09?

$$\text{Answer.....}15.3.$$

6. What is the square root of 368863?

$$\text{Answer.....}607.3409 +$$

7. What is the square root of $\frac{608}{976}$? Answer..... $\frac{4}{7}$
 8. What is the square root of $\frac{7056}{9516}$? Answer..... $\frac{7}{8}$
 9. What is the square root of $37\frac{36}{49}$? Answer..... $6\frac{1}{7}$
 10. What is the square root of $17\frac{34}{147}$? Answer..... $4\frac{1}{7}$
 11. What is the square root of $76\frac{14}{47}$? Answer..... $8.7649 +$
 12. What is the square root of $\frac{1}{2}$ of $\frac{1}{2}$ of $\frac{1}{2}$ of 36? Answer.....3.

THE CUBE ROOT.

THE extraction of the cube root is, the finding a number, which being involved to the third power, will produce the number given.

RULE.

1. Point the given number, both ways, into periods of three figures each, beginning with the unit figure, adding a cipher, or ciphers to the decimal, if necessary: Which points will denote the number of figures the root will consist of.

2. Find the greatest root of the highest period, the cube of which subtract therefrom, and to the remainder bring down the next period for a dividend.

3. Square the root, and multiply it by 3 for a defective divisor*; see how often this number is contained in the dividend (the units and tens place excepted) and place the result to the root, and the square of it to the right of the divisor, supplying the tens place with a cipher, if the square be less than 10.

4. Complete the divisor, by adding to it the product of the root (excepting the last figure) by the last figure, and by 30; multiply and subtract as in division; bring down the next period, and so proceed.

If a fraction be given, reduce it to its lowest terms; if

* For succeeding defective divisors:—Take the last complete divisor, the number which completed it, and twice the square of the last figure in the root; their sum will be such divisor. But the figure in the root, from these divisors, must generally be one or two less than they appear to give.

a surd, to its equivalent decimal; if a mixed number, reduce it to an improper fraction, or a decimal, and then extract the root as above.

PROOF.

Involve the root to the third power, adding to the product the remainder, if any.

EXAMPLES.

1. What is the cube root of 436036.824287?

$$\begin{array}{r}
 436036.824287(75.83 \text{ Answer} \\
 \text{Def. div. } 147,25 \left. \vphantom{\begin{array}{l} 147,25 \\ 1050 \end{array}} \right\} \text{Com. div. } \overline{343} \\
 1050 \left. \vphantom{\begin{array}{l} 147,25 \\ 1050 \end{array}} \right\} = 15775 \quad)93036 \quad 75.83 \times 75.83 \times 75.83 = \\
 \quad \quad \quad 1050 \quad 78875 \quad 436036.824287 \text{ Prf.} \\
 \\
 16875,64 \left. \vphantom{\begin{array}{l} 16875,64 \\ 18000 \end{array}} \right\} = 1705564 \quad)14161824 \\
 18000 \left. \vphantom{\begin{array}{l} 16875,64 \\ 18000 \end{array}} \right\} \quad \quad \quad 18000 \quad 13644512 \\
 \\
 1723692,09 \left. \vphantom{\begin{array}{l} 1723692,09 \\ 68220 \end{array}} \right\} = 172437429 \quad)517312287 \\
 68220 \left. \vphantom{\begin{array}{l} 1723692,09 \\ 68220 \end{array}} \right\} \quad \quad \quad 128 \quad \quad \quad 517312287 \\
 \hline
 0
 \end{array}$$

2. What is the cube root of 16194277?

Answer.....253.

3. What is the cube root of 54854153?

Answer.....379.958.

4. What is the cube root of 673372097.125?

Answer.....876.5

5. What is the cube root of .001906624?

Answer......124

6. What is the cube root of 171.46776406?

Answer.....5.555.

7. What is the cube root of $\frac{343}{1188}$? Answer..... $\frac{7}{11}$

8. What is the cube root of $\frac{4}{27}$? Answer..... $\frac{2}{3}$

9. What is the cube root of 133? Answer.....2.39.

10. What is the cube root of 405.22?

Answer.....7.4

TABLE
OF THE FIRST NINE POWERS.

Roots	Squares	Cubes	4th. power	5th. power	6th. power	7th. power	8th. power	9th. power
1	1	1	1	1	1	1	1	1
2	4	8	16	32	64	128	256	512
3	9	27	81	243	729	2187	6561	19683
4	16	64	256	1024	4096	16384	65536	262144
5	25	125	625	3125	15625	78125	390625	1953125
6	36	216	1296	7776	46656	279936	1679616	10077696
7	49	343	2401	16807	117649	823543	5764801	40353607
8	64	512	4096	32768	262144	2097152	16777216	134217728
9	81	729	6561	59049	531441	4782969	43046721	387420489

A GENERAL RULE

For extracting the Roots of all Powers.

1. Prepare the given number by pointing, agreeably to the required root.

2. Find the first figure of the root by the preceding table of powers; involve it as often as is indicated by the power, and subtract the product from the left hand period; and to the remainder bring down the first figure in the next period for a dividend.

3. Involve the root to the next inferior power to that mentioned in the question, and multiply it by the number denoting the given power for a divisor, by which find a second figure in the root.

4. Involve the whole root to the given power, and subtract it from the two first periods. Bring down the first figure of the next period to the remainder for a new dividend, to which find a new divisor as before; and so proceed till the whole be finished.

The roots of the 4th 6th 8th 9th and 12th powers, may more easily be obtained thus:

For the 4th root, take the square root of the square root,
the 6th, the square root of the cube root.
the 8th, the square root of the 4th root.
the 9th, the cube root of the cube root.
the 12th, the cube root of the 4th root.

PROOF.

Involve the root to the index of the given power, adding to the product the remainder.

EXAMPLES.

1. What is the fifth root of 916132832?

$$\begin{array}{r}
 916132832 \text{ (62 Answer,)} \\
 7776 \\
 \hline
 6480 \overline{) 13853} \quad \begin{array}{l} 6 \times 6 \times 6 \times 6 \times 6 = 7776 \\ 6 \times 6 \times 6 \times 6 \times 5 = 6480 \text{ divisor.} \end{array} \\
 \hline
 62 \times 62 \times 62 \times 62 \times 62 = 916132832 \\
 916132832 \\
 916132832 \\
 \hline
 0
 \end{array}$$

2. What is the fourth root of 140283207936?

Answer.....612.

3. What is the sixth root of 782757789696?

Answer.....96.

4. What is the seventh root of 194754273881?

Answer.....41.

5. What is the 8th. root of 472769874482845188096?

Answer.....384.

6. What is the ninth root of 1352605460594688?

Answer.....48.

7. What is the tenth root of 3743906242624487424?

Answer.....72.

8. What is the 11th. root of 62050608388552823487?

Answer.....63.

9. What is the 12th. root of 614787626176508399616?

Answer.....54.

PRACTICAL QUESTIONS.

1. A square pavement contains 48841 square stones, all of one size; how many are there in one of the sides?

Answer.....221:

2. A castle wall is 45 feet high, a trench surrounding it 60 feet broad; the distance from the outer brink of the trench to the top of the wall is required?

Answer.....75 Feet

3. A certain public expense cost 396£. 1s. each person concerned paid as many shillings as there were men; how many men were there, and what did each one pay?

Men.....89

each.....£.4 9.

4. What is the side of a square acre of land?

Answer.....12.649 + Per. = 12 per. 3 yds. 1 f. 8 in. 1½ bc.

5. What is the side of a square piece of land containing 100 acres? Answer.....126.5 per. near.

6. An orchard of a square form, consists of 14400 trees; how many are there in each row? Answer.....120.

7. A line of 36 yards, will exactly reach from the top of a fort to the opposite bank of a river 24 yards broad; what height in feet is the wall?

Answer.....80.49 + feet.

8. A leaden pipe, $\frac{1}{4}$ inch in diameter, will fill a cistern in 3 hours; what is the diameter of another pipe, which will fill it in one hour?

H. In. H.

.75 X .75 = .5625. As 3 : .5625 :: 1, inversely, to 1.6875. the square root of which is, 1.3 inches, near.....Answer.

9. Two ships sail from the same port; one goes due north 45 leagues, the other due west 76 leagues: How many miles are they asunder?

Answer.....264.9 + miles.

10. If a globe of silver 3 inches diameter, be worth £.45, what is the value of another globe, of 12 inches diameter?

In. £. In.

1st. $3 \times 3 \times 3 = 27$ } As 27 : 45 :: 1728 to £.2880.
2d. $12 \times 12 \times 12 = 1728$ } Answer.

11. A ship of 500 tons has 89 feet keel, 36 feet beam, and 16 feet in the hold; what is the dimensions of a ship of 200 tons of the same shape?

$$89 \times 89 \times 89 = 704969$$

T. F. T. F.

As 500 .. 704969 :: 200 to 281987.6;

The cube root of which is 65.57 feet, the required keel.
F. F. F.

As 89 .. 36 :: 65.57 to 26.5 feet beam,

89 .. 16 :: 65.57 to 11.7 the hold.

12. If a cable 12 inches about, require an anchor of 18 C. weight; of what weight must an anchor be, for a 15 inch cable?

In. cwt. In. C. lb.

As $12 \times 12 .. 18 :: 15 \times 15$ to 28 14 Answer.

13. Suppose a ladder 60 feet in length be so placed, as to reach a window 37 feet from the ground on one side of a street; and, without moving it at the foot, will reach a window of the height of 23 feet on the other side; what breadth is the street? Feet.....102.64+

14. What is the side of a cubical cellar, that shall contain a space of 1953.125 cubic feet? Ans.....12.5 feet.

15. A number of pieces of cloth were purchased for £.691 4s. they cost as many shillings per yard as there were yards in one piece, and there were just as many pieces: Query the number of pieces? Answer.....24 pieces.

16. There is a cubical vessel, whose side is 12 inches; what is the side of a similar vessel, that will contain 3 times as much? 3 Inches.

$12 \times 12 \times 12 \times 3 = 5184$. And $\sqrt[3]{5184} = 17.307$ near.
Answer.

ARITHMETICAL PROGRESSION.

ARITHMETICAL progression is a series of numbers, increasing, or decreasing, by a certain difference. Thus, 1, 2, 3, 4, 5, increase by the continual addition of 1; and 1, 4, 7, 10, 13, by that of 3. Also, 13, 10, 7, 4, 1, by the continual decrease of 3.

In any series of Arithmetical Progression, the sum of the two extremes will equal the sum of any two means, equally distant therefrom. If the terms be uneven, the double of the middle term will equal the extremes. Thus, 1, 4, 7, 10, 13; where, $1 + 13 = 4 + 10 = 7 + 7 = 14$.

CASE I.

The first term, common difference, and number of terms given, to find the last term, and sum of all the terms;

RULE.

The number of terms, less 1, multiplied by the common difference, more the first term, gives the last term.

Then, multiply the sum of the extremes by the number of terms, and half the product will be the sum of all the terms.

EXAMPLES.

1. Bought 30 yards of broadcloth, at 1s. for the first yard, 3s. for the second, 5s. for the third &c. increasing 2s. every yard; what was the price of the last yard, the whole amount, and the average price per yard?

30—1=29	1+59=60	3,0)90,0
2	30	—
—	—	2,0)3,0
58	2)1800	—
+1	—	£.1 10 average
—	2,0)90,0	— price.
2,0)5,9	—	
—	£.45 amount.	
£.2 19 last yard	—	
—		

2. Sixteen persons bestowed charity ; the first gave 5d. the second 9d. the third 13d. &c. what did the last person give, and what did the pauper receive ?

Answer.....the last gave 5s. 5d. sum received 2*£*. 6s. 8d.

3. Suppose 100 stones were laid three yards distant from each other, and a basket placed 3 yards from the first stone ; what distance must a person travel, to gather them singly into the basket ? Answer.....17mil. 1fur. 160pls.

4. P was to serve Q 7 years, to have 10*£*. for the first year, 16*£*. for the second, increasing 6*£*. every year ; what sum had he the last year, what annually, and what for the whole time ? Answer.....last year 46*£*. annually 28*£*. sum 196*£*.

CASE II.

The extremes, and number of terms given, to find the common difference ;

RULE.

Divide the difference of the extremes by the number of terms, less 1, the quotient will be the common difference.

EXAMPLES.

1. A debt of 16 several payments is to be discharged in Arithmetical Progression ; the first payment to be 14*£*. the last 100*£*. required the common difference, each payment, and the whole debt ?

$$\begin{array}{rcl}
 \text{£. } 100 - 14 & & \\
 \hline
 16 - 1 & = & \begin{array}{l} 5 \ 14 \ 8 \text{ common diff.} \\ 14 \ 0 \ 0 \text{ first payment.} \\ \hline 19 \ 14 \ 8 \text{ second} \\ \hline 25 \ 9 \ 4 \text{ third} \\ \hline 31 \ 4 \ 0 \text{ fourth, \&c.} \end{array}
 \end{array}$$

$$14 + 100 \times 8 = \text{£. } 912 \text{ whole debt.}$$

2. A footman would travel a certain distance in 19 days, to go 6 miles the first day, increasing every day by an equal excess, so that the last days journey may be 60 miles ; what is the common difference, and distance of the journey ? Difference 3 miles, and distance 627.

GEOMETRICAL PROGRESSION.

GEOMETRICAL progression is a series of numbers, increasing by a certain multiplier, or decreasing by a certain divisor. Thus, 1, 2, 4, 8, 16, 32, 64, increase by the common multiplier 2; and 729, 243, 81, 27, 9, 3, 1, decrease by the common divisor 3.

In any series of numbers, in Geometrical Progression, the product of the two extremes, is equal to the product of any two means, equally distant therefrom; or of the product of the middle term by itself: Thus, 1, 3, 9, 27, 81, 243, 729; where, $1 \times 729 = 3 \times 243 = 9 \times 81 = 27 \times 27 = 729$.

The common multipliers, and the common divisors, are called ratios; and the continual multiplying of the ratios a certain number of times, is called raising the ratio to such a power. Thus, $3 \times 3 \times 3 \times 3 \times 3 \times 3 = 729$, the 6th power of 3. See table of Powers, page 157.

RULE.

1. To find the last term in any series of Geometrical Progression;

Involve the ratio to a power equal to the number of terms, less 1; which power, multiply by the first term, for the last term.

2. To find the sum of all the terms; raise the ratio to a power equal to the number of terms; which may be done by taking it from the table of powers, if it be found therein; but, if the power required be higher, then multiply the result by a power sufficiently high*.

From this power, subtract 1; divide the remainder by the ratio, less 1, and multiply the quotient by the first term, for the sum of the series.

If the ratio be 1 greater than the first term, dividing, and multiplying as above, may be omitted.

* Suppose the 25th power of 3 be required: The 9th power of 3 = 19683. $19683 \times 19683 = 387420489$, the 18th power; which, multiplied by 2187, the 7th power = 847288609443, the 25th power.

EXAMPLES.

1. Sold 12 ounces of Gold, at one farthing for the first ounce, a penny for the second, 4d. for the third, &c. in quadruple Proportion; what was the value of the last ounce, and what did the whole amount to? And supposing it to have cost 4*£*. an ounce, what was gained thereby?

$$\begin{array}{r} 11 \\ 4 \overline{) 4194334} \text{ qrs.} = \text{£.}4369 \text{ ls. 4d. last oz.} \end{array}$$

$$\begin{array}{r} 9 \\ 4 \overline{) 262146} \\ 3 \\ 4 \overline{) 64} \end{array} \left. \vphantom{\begin{array}{r} 9 \\ 4 \overline{) 262146} \\ 3 \\ 4 \overline{) 64} \end{array}} \right\} \text{Multiply.}$$

$$16777216 = 12\text{th power.}$$

$$-1$$

$$4-1=3)16777215$$

$$4) 5592405 \text{ qrs.}$$

$$12) 1398101\frac{1}{2}$$

$$2,0) 11650,8 \text{ 5.}$$

$$\begin{array}{r} \text{£.}5825 \text{ 8 } 5\frac{1}{4} \text{ sold for.} \\ 12 \times 4 = 48 \text{ prime cost.} \end{array}$$

$$\text{£.}5777 \text{ 8 } 5\frac{1}{4} \text{ gained.}$$

2. Suppose A man wrought 20 days, and received for the first day's labour 4 grains of wheat; for the second, 12; for the third, 36, &c. and the wheat disposed of at 7*½*d. the Bushel; what did the 20 days labour amount to, allowing 7680 grains to equal one pint?

$$\text{Answer.....£.}5320 \text{ 2 6.}$$

3. Sold 13 yards of cloth, at 2d. for the first yard, 4d. for the second, 8d. for the third, &c. what did it amount to, and what was the average price a yard?

$$\text{Answer.....£.}68 \text{ 5 2 and £.}5 \text{ 5 } \frac{1}{4} \text{ a yard.}$$

4. If 30 bushels of wheat be sold at 2d. for the first bushel, 4d. for the second, 8d. for the third, &c. the amount is required, and the average price per bushel?

$$\begin{array}{r} \text{Amount.....£.}8947848 \text{ 10 6} \\ \text{per bush.....}298261 \text{ 12 4 } \frac{1}{4} \end{array}$$

5. What sum would purchase a horse, on which were 4 shoes, and 8 nails in each shoe, at one farthing for the first nail, a half penny for the second, &c. doubling to the last?

Answer.....£.4473924 5 3 $\frac{1}{2}$

6. If an English guinea be a maiden's dowry for the first month of the year, and trebled in Geometrical Progression on every month thro' the year; what sum did she receive in Pennsylvania currency? Answer.....£.465010.

7. Sold 30 yards of broad cloth, at 2 pence for the first yard, 6 for the second, 18 for the third, &c. these disposed of at 1000 for a farthing, what did the cloth amount to? And, supposing the prime cost to have been £.100 per yard, what was gained thereby?

Amount.....£.214469929 5 3 $\frac{1}{2}$

Gained.....214466929 5 3 $\frac{1}{2}$

8. If 36 head of cattle be disposed of thus; 2d. for the first, 4d. for the second, doubling to the last; what do they amount to? And what was the average price per head?

Amount.....£.572662306 2 6

per head.....15907286 5 7 $\frac{1}{2}$

9. What is the compound interest of a farthing, at 6 per cent per annum, from the commencement of the Christian era, to the year 1784?*

£. 1486716346568708209435714551509890767065361
1s. 3 $\frac{1}{4}$ d. Answer.

Which sum is more than 415 millions of millions of worlds as large as ours, were they of solid gold, and coined into guineas.
(*Pike's Arithmetic.*)

* In 11 years and 325 days, money at 6 per cent, compound interest will double itself; hence, 1784 years, divided by 11 years and 325 days, quotes 150; to which the ratio 2 must be raised.

SIMPLE INTEREST BY DECIMALS.

TABLE OF RATIOS.

Rate p. cent.	Ratios.	Rate p. cent.	Ratios.	Rate p. cent.	Ratios.
1	.01	4	.04	7	.07
$1\frac{1}{2}$	.0125	$4\frac{1}{4}$	.0425	$7\frac{1}{4}$	.0725
$1\frac{1}{2}$	.015	$4\frac{1}{2}$	.045	$7\frac{1}{2}$	.075
$1\frac{3}{4}$	.0175	$4\frac{3}{4}$	.0475	$7\frac{3}{4}$	.0775
2	.02	5	.05	8	.08
$2\frac{1}{4}$	.0225	$5\frac{1}{4}$	.0525	$8\frac{1}{4}$	.0825
$2\frac{1}{2}$	.025	$5\frac{1}{2}$	.055	$8\frac{1}{2}$	.085
$2\frac{3}{4}$	.0275	$5\frac{3}{4}$	.0575	$8\frac{3}{4}$	.0875
3	.03	6	.06	9	.09
$3\frac{1}{4}$	.0325	$6\frac{1}{4}$	.0625	$9\frac{1}{4}$	.0925
$3\frac{1}{2}$	.035	$6\frac{1}{2}$	.065	$9\frac{1}{2}$	.095
$3\frac{3}{4}$	.0375	$6\frac{3}{4}$	.0675	$9\frac{3}{4}$	.0975
				10	.1

Ratio is the simple interest of 1*£*. for 1 year, at the rate per cent agreed on ; and is thus found :

As 100 :: 1 :: 1 to .01

100 :: 6 :: 1 to .06

100 :: $9\frac{1}{4}$:: 1 to .0975 &c.

A TABLE

Of the decimal parts of a year, equal to any number of days ; also of months, and quarters of a year.

Days	Decimal parts.	Days	Decimal parts.	Months	Decimal parts.
1	.00274	25	.06849	1	.08333
2	.00548	30	.08219	2	.16666
3	.00822	40	.10959	1 qr. 3	.25
4	.01096	50	.13699	4	.33333
5	.0137	60	.16438	5	.41666
6	.01644	70	.19178	2 qr. 6	.5
7	.01918	80	.21918	7	.58333
8	.02192	90	.24658	8	.66666
9	.02466	100	.27397	3 qr. 9	.75
10	.0274	200	.54795	10	.83333
15	.04109	300	.82192	11	.91666
20	.05479	365	1.00000	12	1.00000

The construction of the foregoing table is, by dividing the given days, months, or quarters, by the number of their integral parts of a year. Thus,

$$365)20=.05479, \&c.$$

For days not in the table, take the sum of their respective decimals; thus, for 264 days;

$$\begin{array}{r} 200=.54795 \\ 60=.16438 \\ 4=.01096 \\ \hline 264=.72329 \end{array}$$

CASE 1.

The principal, rate, and time given, to find the interest and amount:

RULE.

The principal multiplied by the ratio, will be the interest for one year; which, multiply by the time given, for the interest for years. To this, add the principal for the amount.

EXAMPLES.

1. What is the interest and amount, of £.917 16 for 7 years, at 5 per cent per annum?

$$\begin{array}{r} \text{£.} \\ 917.8 \\ .05 \text{ ratio} \\ \hline 45.890 \text{ Int. for 1 year.} \\ 7 \\ \hline \text{£. s. d.} \\ 321.23 = 321 \text{ } 4 \text{ } 7.2 \text{ interest.} \\ 917.8 \text{ principal.} \\ \hline \end{array}$$

$$\text{£.1239.03} = 1239 \text{ } 0 \text{ } 7.2 \text{ amount.}$$

2. What is the interest of 7200£. for $6\frac{1}{2}$ years, at 5 per cent per annum? Answer.....£.2340.

3. What sum will £.320 15 amount to in 3 years and 9 months, at $6\frac{1}{2}$ per cent per annum?

$$\text{Answer.....£.398 } 18 \text{ } 7 \text{ } 3.5$$

4. What is the amount of a bond for dols.627 17cts. at $5\frac{1}{2}$ per cent per annum, from 3mo. 5th. to 11mo. 23rd. inclusive? Answer.....dols.650 89cents.

CASE 2.

The amount, time, and rate given, to find the principal;

RULE.

Multiply the ratio by the time, and add a unit to the product for a divisor; by which divide the amount, and the quotient will be the principal.

EXAMPLES.

1. What principal will amount to £.1239 0 7.2 in 7 years, at 5 per cent per annum?

$$.05 \times 7 + 1 = 1.35 \text{ Divisor.}$$

$$1.35)1239.03(917.8 = \text{£.917 16s. Answer.}$$

1215

240 &c.

2. What principal will amount to £.9540 in $6\frac{1}{2}$ years. at 5 per cent per annum? Answer.....£.7200.

3. What principal will amount to £.398 18 7d. 3.5, in 3 years and 9 months, at $6\frac{1}{2}$ per cent per annum?

$$\text{Answer.....£.320 15.}$$

CASE 3.

The amount, principal, and time given, to find the rate per cent;

RULE.

The amount, less the principal, divided by the product of the time and principal, will give the ratio.

EXAMPLES.

1. At what rate per cent will £.917 16 amount to £.1239 0 7.2 in 7 years?

$$\begin{array}{r} \text{£.} \quad \text{£.} \\ 917.8 \quad 1239.03 \\ 7 \quad 917.8 \end{array}$$

$$6424.6)321.230(.05 \text{ ratio} = 5\text{£. per cent. Answer.}$$

321230

At what rate per cent will 7200£. amount to 9540£. in $6\frac{1}{2}$ years? Answer..... 5£.

3. At what rate per cent will £.320 15 amount to £.398 18 7 3.5, in 3 years and 9 months?

Answer..... $6\frac{1}{2}$ £.

CASE 4.

The amount, principal, and rate per cent given, to find the time;

RULE.

The amount, less the principal, divided by the product of the ratio and principal, will give the time.

EXAMPLES.

1. In what time will £.917 16 amount to £.1239 0 7.2, at 5 per cent per annum?

$$\begin{array}{r} \text{£.} \quad \text{£.} \\ 917.8 \quad 1239.08 \\ .05 \quad 917.8 \\ \hline \end{array}$$

$$\begin{array}{r} 45.890 \quad 321.23 \text{ (7 years. Answer,} \\ \quad \quad 321.23 \\ \hline \end{array}$$

2. In what time will £.7200 amount to £.9540, at 5 per cent per annum? Answer..... $6\frac{1}{2}$ years.

3. In what time will £.320 15 amount to £.398 18 7 3.5, at $6\frac{1}{2}$ per cent per annum?

Answer..... 3 years 9 months.

POLICIES OF INSURANCE.

INSURANCE is a security by a policy, or instrument of writing, granted by insurers, to indemnify for losses sustained, on a ship and cargo, or either of them, or on a part of either; and is reckoned at a certain premium per cent, according to agreement.

Policies should be taken for sums sufficient to cover both the principal and premium.

To find the insurance on any sum, see page 92, Simple Interest.

CASE 1.

To find the sum, for which a policy should be taken, to cover a given sum ;

RULE.

- Take the premium per cent from 100 ; then say,
As the remainder,
Is to 100,
So is the sum adventured,
To the policy.

EXAMPLES.

1. What sum must a policy contain, to cover 759 dols. premium 8 per cent ?

dols. dols. dols. dols.

100 As 92 :: 100 :: 759

8

100

92

92)75900(825dols. Answer.

736

230 &c.

2. A merchant sent a vessel and cargo to sea, valued at dols.4066 cts.66 ; for what sum must the policy be taken, premium at $19\frac{1}{2}$ per cent ?

Answer.....dols 5051 cents75.

CASE 2.

To find the premium, when the policy is taken out for a certain sum ;

RULE.

- As the policy,
Is to the covered sum ;
So is 100
To a fourth number ;
Which, being taken from 100, leaves the premium.

EXAMPLES.

1. If a policy be taken out for 825dols. to cover 759dols. what is the premium per cent?

dols. dols. dols.

As 825 .. 759 :: 100

100

———100

825)75900(92

7425 —

——— 8 dols Answer.

165 &c.

. What is the premium per cent on a policy of 3456dols. 75cts. to cover 1382dols. 70cts.?

Answer.....60 dols.

CASE 3.

To find the sum to be covered, when the policy, and premium per cent are given;

RULE.

Deduct the premium per cent from 100; then say, .

As 100,

Is to the remainder,

So is the policy,

To the sum required.

EXAMPLES.

1. What is the adventure, at 8 per cent on a policy for dols.825?

dols. dols. dols.

100—8=92. As 1,00 .. 92 :: 8,25

92

———1650

7425

dols.759.00. Answer.

2. If a policy be taken out for 3456dols. 75cts. at 60 per cent; what is the sum to be covered?

Answer.....1382dols. 70cts.

CASE 4.

When a given sum is adventured on a trading voyage, either at the same, or different risks, and it is required to take out a policy for such a sum as will cover the adventure ;

RULE.

Involve 100 to the power denoted by the number of risks, which multiply by the sum adventured, for a dividend. Subtract each several premium from 100, and take the continual product of the remainders for a divisor ; the quotient will cover the adventure.

EXAMPLES.

1. A merchant adventured 480dols. 50cts. from Newburyport to South-Carolina, from thence to Jamaica, and from thence home ; the premium 5 per cent from port to port ; what must he take out a policy for, to cover his adventure ?

$$\frac{100 \times 100 \times 100 \times 480.5}{5} = 480500000$$

$$95 \times 95 \times 95 = 857375 \quad 480500003 (560\text{dols. } 48\text{cts. Ans.}$$

2. A merchant adventured 1333dols. 34cts. from Boston to Philadelphia, at 3 per cent, from thence to Guadeloupe, at 4, from thence to Nantz, at 5, and from thence home at 6 : for what sum must he take out a policy, to cover his adventure ? Answer.....1603dols. 41cts.

CASE 5.

When a given sum is adventured upon a trading voyage, either at the same, or different risks, from port to port, and the premium for the voyage is required ;

RULE.

Find the sum for which the policy must be taken, by the last case. Multiply the sum adventured by 100, and divide the product by the policy. Take the quotient from 100, and the remainder will be the premium per cent on the policy.

EXAMPLES.

1. A merchant adventured 480dols. 50cts. from Newburyport to South-Carolina, from thence to Jamaica, and from thence home; the premium 5 per cent from port to port; what will be the premium, equal to the several given premiums, on the policy which will cover the adventure?

Policy found by last case 560dols. 43cts.

dols. cts.

$$480 \ 50 \times 100 = 48050.$$

$$560 \ 43 \times 48050 = 85 \text{dols. } 73 \text{cts.}$$

$$100 - 85 \ 73 = 14 \text{dols. } 27 \text{cts. Answer.}$$

2. A merchant adventured 500dols. from Boston to Philadelphia, at 3 per cent; from thence to Guadaloupe, at 4; from thence to Nantz, at 5; and from thence home, at 6: what will be the premium, equal to those given in the question, on a policy for covering the above adventure?

Answer.....16dols. 63cts.

CASE 6.

If a policy be taken out for a given sum, to cover a certain adventure from one port to another to several ports, at equal premiums from one place to another, to find what that equal premium is;

RULE.

Involve 100 to that power denoted by the number of risks, and multiply this power by the sum adventured; divide the last product by the policy: Extract such a root of the quotient denoted by the number of risks; which root take from 100 $\frac{c}{t}$. and the remainder will be the equal premium from port to port.

EXAMPLES.

1. A merchant adventured 480dols. 50cts. from Newburyport to South Carolina, from thence to Jamaica, and from there home; to cover which, he took out a policy for 560dols. 43cts, and the premium was equal from one place to the other; what was the premium per cent?

2

$$\begin{array}{r}
 100 \times 100 \times 100 \times 480.5 = 480500000. \\
 \begin{array}{r}
 3 \qquad 100 \\
 560.43) 480500000 (\sqrt{857375} = 95 \\
 \underline{448344} \\
 32156 \text{ \&c.}
 \end{array}
 \end{array}$$

5 per cent.

CASE 7.

When an adventure is insured out and home at one risk, at a given rate per cent, and the voyage terminates short of what was intended ; to find what the underwriter must receive per cent ;

RULE.

If just half the voyage be performed, it must be considered as two equal risks ; if one third, as three ; and if one fourth as four risks ; and by case 1st. must be found the amount which will cover the adventure the whole voyage.

Involve 100 to the power denoted by the number of risks, which power multiply by the sum adventured. Divide this product by the aforesaid amount, and extract such a root of the quotient as is denoted by the number of risks. This root taken from 100 will leave the sum per cent the underwriters must receive.

EXAMPLE.

A merchant covers 2000 dols. at 6 per cent from Philadelphia to the West-Indies, and home again ; but the voyage terminating in the West-Indies, what must the insurer receive per cent ?

$$\begin{array}{r}
 100 \quad \text{As } 94 \text{ .. } 100 :: 2000 \text{ to } 2127.65 \\
 \begin{array}{r}
 6 \\
 \hline
 94
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 100 \times 100 \times 2000 = 20000000 \\
 \begin{array}{r}
 100 \\
 2127.65) 20000000 (\sqrt{9400} = 96.95 \\
 \underline{1914885}
 \end{array}
 \end{array}$$

Dols. 3.05 Answer.

851150, &c.

COMPOUND INTEREST BY DECIMALS.

By the ratio in compound interest is meant, the amount of £.1, or dollar for one year; to find which,

As 100 .. 103 :: 1 to 1.03

100 .. 104 10 :: 1 to 1.045 &c. table 1.

For quarterly amounts, take the 4th root of the ratio; for half yearly, the square root; and, for 3 quarters, the product of the quarterly and half yearly.

Thus, $\sqrt[4]{1.03} = 1.007417$; $\sqrt{1.03} = 1.014889$; and $1.007417 \times 1.014889 = 1.022416$, for 3 quarters.

TABLE I.

Rate per cent.	Amounts of £.1 for a year and for quarters, at Compound Interest.				Simp. int. of £.1 for 1 month.
	Ratio	For 3 qrs.	For 2 qrs.	For 1 qr.	
3	1.03	1.022416	1.014889	1.007417	.002500
3½	1.035	1.026137	1.017349	1.008637	.002917
4	1.04	1.029852	1.019804	1.009853	.003333
4½	1.045	1.033563	1.022252	1.011065	.003750
5	1.05	1.037270	1.024695	1.012272	.004167
5½	1.055	1.040973	1.027132	1.013475	.004583
6	1.06	1.044671	1.029536	1.014674	.005000
6½	1.065	1.048364	1.031988	1.015868	.005417
7	1.07	1.052053	1.034408	1.017058	.005833

The following table exhibits the ratios at the head thereof, involved to the number of years opposite, in the side column; and shews the amount of £.1, or dollar, for that time. By involving of which, the amount for any number of years is obtained.

Thus, $1.06^{10} = 1.7908476$, the amount of 1£. or dollar, for 10 years; and $1.7908476 \times 1.7908476 = 3.2071355$, the amount for 20 years. Thus the amount, for any number of years may be obtained, beyond the limits of the table.

TABLE II.

Shewing the amount of 1*£*. from 1 year to 50.

yr.	3½ p. cent.	4 p. cent.	4½ p. cent.	5 p. cent.	5½ p. cent.	6 p. cent.
1	1,0350000	1,0400000	1,0450000	1,0500000	1,0550000	1,0600000
2	1,0712250	1,0816000	1,0920250	1,1025000	1,1130250	1,1236000
3	1,1087178	1,1248640	1,1411661	1,1576250	1,1742413	1,1910160
4	1,1475230	1,1698585	1,1925186	1,2155062	1,2388246	1,2624769
5	1,1876863	1,2166329	1,2461819	1,2762815	1,3069598	1,3388256
6	1,2292553	1,2653190	1,3022601	1,3400956	1,3788426	1,4185191
7	1,2722792	1,3159317	1,3608618	1,4071004	1,4546789	1,5036302
8	1,3168090	1,3685690	1,4210006	1,4774554	1,5346862	1,5938480
9	1,3628973	1,4233118	1,4860051	1,5512282	1,6190939	1,6894789
10	1,4105987	1,4802442	1,5529694	1,6288946	1,7081440	1,7908476
11	1,4599697	1,5394540	1,6228530	1,7103393	1,8020919	1,8982985
12	1,5110686	1,6010322	1,6958814	1,7958563	1,9012069	1,0121964
13	1,5630560	1,6650735	1,7721961	1,8856491	2,0057732	2,1282982
14	1,6186945	1,7316764	1,8519449	1,9799316	2,1160907	2,2609039
15	1,6753488	1,8009435	1,9352824	2,0789281	2,2324756	2,3965581
16	1,733986	1,8729812	2,0223701	2,1828745	2,3552617	2,5403516
17	1,7946755	1,9479005	2,1133768	2,2920183	2,4848011	2,6927727
18	1,8574892	2,0258161	2,2084787	2,4066192	2,6214652	2,8543391
19	1,9225013	2,1068491	2,3078603	2,5269502	2,7656458	3,0255991
20	1,9989788	2,1911231	2,4117140	2,6532975	2,9177563	3,2071355
21	2,0594314	2,2787680	2,5202411	2,7859625	3,0782329	3,3995635
22	2,1315115	2,3699187	2,6336520	2,9252607	3,2475357	3,6035373
23	2,2061144	2,4647155	2,7521663	3,0715237	3,4215502	3,8197495
24	2,2833284	2,5613041	2,8760138	3,2250999	3,6145885	4,0489393
25	2,3632449	2,6658363	3,0054344	3,3863549	3,8133910	4,2918707
26	2,4459985	2,7724696	3,1406790	3,5556729	4,0231279	4,5493829
27	2,5315671	2,8833685	3,2820095	3,7334563	4,2443991	4,8223459
28	2,6201719	2,9987033	3,4296999	3,9201291	4,4778119	5,1168664
29	2,7118779	3,1186514	3,5840364	4,1161356	4,7241231	5,4183876
30	2,8067937	3,2433975	3,7453181	4,3219423	4,9839499	5,7434912
31	2,9050311	3,3731334	3,9138574	4,5380394	5,2580671	6,0881007
32	3,0067075	3,5080587	4,0899810	4,7649414	5,5472608	6,4533867
33	3,1119423	3,6483811	4,2740301	5,0031885	5,8523600	6,8405899
34	3,2208603	3,7943163	4,4663615	5,2533479	6,1742398	7,2510253
35	3,3335904	3,9460889	4,6673478	5,5160152	6,5138230	7,6860868
36	3,4502661	4,1039325	4,8773784	5,7918101	6,8720832	8,147252
37	3,5710254	4,2680898	5,0968604	6,0814069	7,2500478	8,6360871
38	3,6950113	4,438834	5,3262192	6,3854772	7,6488004	9,1542523
39	3,8253717	4,6163659	5,5651990	6,7047511	8,0694844	9,703574
40	3,9592597	4,8010206	5,8163645	7,0399887	8,5133061	10,2857178
41	4,0978337	4,9930614	6,0781009	7,3919881	8,9815378	10,9028608
42	4,2412579	5,1927838	6,3517246	7,7615871	9,4755224	11,5570325
43	4,3897022	5,4004952	6,6375522	8,1496669	9,9967611	12,2504547
44	4,5433410	5,6165150	6,9362421	8,5571502	10,5464933	12,9854817
45	4,7023585	5,8411756	7,248373	8,9850077	11,1215504	13,766107
46	4,8669411	6,0748236	7,5745497	9,4342581	11,7385217	14,5904873
47	5,0372840	6,3178166	7,9154045	9,9059710	12,3841404	15,4659166
48	5,213588	6,5705203	8,2715977	10,4012696	13,0652681	16,3038716
49	4,3960645	6,8333493	8,6438196	10,9213331	13,7838579	17,3775039
50	5,5849268	7,1066833	9,0327915	11,4673697	14,5419700	18,401541

CASE 1.

The principal, time, and rate given, to find the amount, or interest ;

RULE.

Involve the ratio to the number of years, (or find the power in table II.) which power, multiply by the principal for the amount ; from which, subtract the principal, and the remainder will be the interest. If quarters, or quarters, months, &c. be given with the years, multiply the amount for the years by those of the quarters, adding to the product for the months and days. Suppose 3 years, 7 months, 15 days, at $4\frac{1}{2}$ per cent per annum :

Table II. for 3 years = 1.1411661 } multiplied = 1.166559
 I. for 2 qrs. = 1.022252 }
 To which add the simple int. of 1*l*. for 1 mo. = .003750
 Parts for - - - - - 15 days = .001875

Amount of 1*l*. for 3 yrs. 7 mo. 15 days = 1.172184

EXAMPLES.

1. What sum will *l*.450 amount to in 3 years, at 5 per cent per annum ?

$1.05^3 = 1.157625$ } multiply
 450

520.931250 = *l*.520 18 7 $\frac{1}{2}$ amount,
 450 0 0

l.70 18 7 $\frac{1}{2}$ interest.

2. What is the amount at compound interest of *l*.259 10 6, for 3 years, 7 months and 15 days, at $4\frac{1}{2}$ per cent per annum ?

$1.045^3 = 1.1411661 \times 1.022252 = 1.166559$
 1 mo. 15 da. = .005625

3 yr. 7 mo. 15 da. = 1.172184

1.172184 \times 259.535 = *l*.304 4 2 $\frac{1}{2}$ Answer

3. What is the amount, and what the compound interest of £.136 15 6 for 20 years, at 6 per cent per ann.?

Answer..... $\left\{ \begin{array}{l} \text{Amount } \text{£.}438 \ 13 \ 1\frac{1}{2}. \\ \text{Interest } \text{£.}301 \ 17 \ 7\frac{1}{2}. \end{array} \right.$

4. What is the compound interest of a bond for 764 dollars for 4 years and 9 months, at 6 per cent. per ann.?

Answer.....243 dols. 61 cts.

CASE 2.

The amount, rate, and time given, to find the principal;

RULE.

The amount divided by the ratio involved to the time, the quotient will be the answer.

EXAMPLES.

1. What principal, at 5 per cent. per annum for three years, will amount to £.520 18 7 $\frac{1}{2}$?

$$\begin{array}{l} 1.05^3 = 1.157625 \\ 1.157625 | 520.931250 = \text{£.}450 \text{ Answer.} \end{array}$$

2. What sum will purchase a bond of £.304 4 2 $\frac{1}{2}$, payable 3 years, 7 months, and 15 days hence, at 4 $\frac{1}{2}$ per cent per annum? Answer.....£.259 10 5 $\frac{1}{2}$.

3. What is the present worth of £.1007 12 5 $\frac{1}{2}$, due 4 years and 9 months hence, discounting at 6 per cent. per annum? Answer.....£.764 +.

4. What is the present worth of dols. 2019 97 cents, due 4 years hence, discount at 6 per cent per annum? Answer.....Dols. 1600.

5. What principal must be put to interest for 6 years, at 4 $\frac{1}{2}$ per cent. per annum, to amount to Dols. 10418 08 cents. ? Answer.....£.8000 dollars.

CASE 3.

The principal, rate, and amount given to find the time ;
RULE.

Divide the amount by the principal, and involve the ratio till it equals the quotient, the power will indicate the time. Or,

By table II. find the quotient under the rate, and it will shew the time against it.

If the quotient be between two numbers under the rate, say, As the difference of these numbers is to 12 months ; so is the difference between the upper number and the quotient, to the months (nearly) more than the years.

EXAMPLES.

1. In what time will £.450 amount to £.520 18 7½,
 at 5 per cent. per annum ?

$$450)520.93125(1.157625$$

$1.05 \times 1.05 \times 1.05 = 1.157625 = 3 \text{ years. Answer.}$
 And, in table II. under 5, and opposite 1.157625, is 3 years.

2. In what time will £.600 amount to £.757 9 8½,
 at 6 per cent. per annum ? Ans..... 4 years.

3. In what time will £.764 amount to £.1007 12 5½,
 at 6 per cent. per annum ?

$$764)1007.621875(1.3188767=4\frac{1}{2}\text{ years.}$$

$$1.3382256$$

$$1.2624769$$

$$1.2624769$$

mo.

mo.

As .0757487 .. 12 :: .0563998 to 8.93478 = 9 near.

Answer..... 4 years 9 mo.

CASE 4.

The principal, amount, and time given, to find the rate per cent ;

RULE.

Divide the amount by the principal, and extract such a root of the quotient as is indicated by the time, for the ratio. Or,

By table II; find the quotient against the time, and over it will be the rate.

When parts of a year are to be considered, express the time in the lowest vulgar fraction; then, involve the said quotient to the power indicated by the denominator, and of this power, extract the root denoted by the numerator for the ratio. Or, by table II, find the numerator in the column of years, and over the power, opposite the years, will be the rate.

EXAMPLES.

1. At what rate per cent will £.450 amount to £520 18 7½ in 3 years?

$$450)520.93125(1.157625$$

3

• • • $\sqrt[3]{1.157625} = 1.05$ ratio = 5 per cent, Answer.

Table II. opposite 3 years, over 1.157625, is 5 per cent.

2. At what rate per cent will £.600 14 amount to £.932 17 4½, in 10 years. Answer.....4½

3. At what rate per cent will £.418.2432 amount to £.520.93125, in 4 years and 6 months?

$$418.2432)520.93125(1.245523\overline{2} = 1.5513282$$

$$418 \ 2432$$

$$10268805 \ \&c.$$

$$4\frac{1}{2} = \frac{9}{2}$$

9

$$\sqrt[9]{1.5513282} = 1.05 \text{ ratio} = 5 \text{ per cent.}$$

And in Table II. opposite 9, is 1.5513282, and over it, 5.

ANNUITIES AT COMPOUND INTEREST.

ANNUITIES are certain sums of money payable yearly, half yearly, or quarterly, for any particular number of years, or forever; and draw interest, if unpaid, after they become due.

TABLE III.
Shewing the amount of 1*l*. Annuity.

yr	4 per cent.	4½ per cent.	5 per cent.	5½ per cent.	6 per cent.	yr
1	1.	1.	1.	1.	1.	1
2	2.04	2.045	2.05	2.055	2.06	2
3	3.1216	3.137025	3.1525	3.168025	3.1836	3
4	4.246464	4.278191	4.310125	4.342266	4.374602	4
5	5.416322	5.47071	5.525631	5.581091	5.637093	5
6	6.632975	6.716892	6.801913	6.888051	6.975318	6
7	7.898294	8.019152	8.142008	8.266894	8.393837	7
8	9.214226	9.380014	9.549109	9.721573	9.897468	8
9	10.582795	10.802114	11.026564	11.256259	11.491316	9
10	12.006107	12.28821	12.577892	12.875354	13.180795	10
11	13.486351	13.841179	14.206787	14.583498	14.971643	11
12	15.025805	15.464032	15.917126	16.38559	16.869942	12
13	16.626838	17.159913	17.712983	18.286798	18.882138	13
14	18.291911	18.932109	19.598652	20.292572	21.015066	14
15	20.023588	20.784054	21.578563	22.408663	23.275971	15
16	21.824531	22.719337	23.657492	24.64114	25.672528	16
17	23.697512	24.741707	25.840366	26.996402	28.212881	17
18	25.645413	26.855084	28.132385	29.481205	30.905653	18
19	27.671229	29.063562	30.539004	32.102671	33.759993	19
20	29.778078	31.371423	33.065954	34.868318	36.785592	20
21	31.969202	33.783137	35.719252	37.786075	39.992728	21
22	34.24797	36.303378	38.505214	40.864309	43.392291	22
23	36.617888	38.93703	41.430475	44.111846	46.995828	23
24	39.082604	41.689196	44.501999	47.537998	50.815578	24
25	41.645908	44.56521	47.727099	51.152588	54.864513	25
26	44.311745	47.570645	51.113454	54.965979	59.156383	26
27	47.084214	50.711324	54.669126	58.989109	63.705766	27
28	49.967582	53.993333	58.402583	63.23351	68.528112	28
29	52.966286	57.423033	62.322712	67.711353	73.639798	29
30	56.084938	61.007069	66.438847	72.435478	79.058186	30
31	59.328335	64.752388	70.76079	77.419429	84.801677	31
32	62.701469	68.666145	75.298829	82.677498	90.889778	32
33	66.209527	72.756226	80.063771	88.22476	97.343165	33
34	69.857904	77.030256	85.066959	94.077122	104.183754	34
35	73.652225	81.496618	90.320307	100.251363	111.434780	35
36	77.598314	86.163966	95.836323	106.765188	119.120867	36
37	81.702246	91.041344	101.628139	113.637274	127.268118	37
38	85.970336	96.138205	107.709546	120.887324	135.904206	38
39	90.40915	101.464424	114.095023	128.536127	145.05845	39
40	95.025516	107.030323	120.799774	136.695615	145.76190	40

TABLE IV.

yr.	4 p. cent.	4½ p. cent.	5 p. cent.	5½ p. cent.	6 p. cent.	yr.
1	0,06154	0,05694	0,05231	0,04786	0,04339	1
2	1,88609	1,87267	1,85941	1,84632	1,83339	2
3	2,77509	2,74876	2,72324	2,69793	2,67301	3
4	3,62989	3,58752	3,54595	3,50514	3,4651	4
5	4,45182	4,38997	4,32948	4,27028	4,21236	5
6	5,24214	5,15787	5,07569	4,99553	4,91732	6
7	6,02025	5,8927	5,78637	5,68297	5,58238	7
8	6,73274	6,59589	6,46321	6,33457	6,20979	8
9	7,43533	7,26879	7,10781	6,95220	6,80169	9
10	8,11089	7,91272	7,72173	7,53762	7,36008	10
11	8,76048	8,52892	8,30641	8,09254	7,88687	11
12	9,38507	9,11858	8,86325	8,61852	8,38384	12
13	9,98565	9,68285	9,39357	9,11708	8,85268	13
14	10,56312	10,22282	9,89864	9,58965	9,29498	14
15	11,11839	10,73954	10,37965	10,03759	9,71225	15
16	11,65229	11,23401	10,83777	10,46216	10,10589	16
17	12,16567	11,70719	11,27407	10,86461	10,47726	17
18	12,65929	12,15999	11,68958	11,24607	10,8276	18
19	13,13394	12,59329	12,08532	11,60765	11,15811	19
20	13,5932	13,00793	12,46221	11,95038	11,46992	20
21	14,02916	13,40472	12,82115	12,27524	11,76408	21
22	14,45111	13,78442	13,163	12,58317	12,04158	22
23	14,85684	14,14777	13,48857	12,87504	12,30338	23
24	15,24696	14,49548	13,79864	13,15170	12,55036	24
25	15,62208	14,82821	14,09394	13,41391	12,78335	25
26	15,98277	15,14661	14,37518	13,66250	13,00316	26
27	16,32959	15,4513	14,64303	13,89810	13,21053	27
28	16,66306	15,74287	14,89813	14,12142	13,40616	28
29	16,98371	16,02189	15,14107	14,33310	13,59072	29
30	17,29203	16,28889	15,37245	14,53375	13,76483	30
31	17,58849	16,54439	15,59281	14,72393	13,92908	31
32	17,87355	16,78889	15,80268	14,90420	14,08404	32
33	18,14764	17,02286	16,00255	15,07507	14,23023	33
34	18,41126	17,24676	16,1929	15,23703	14,36814	34
35	18,66461	17,46101	16,37419	15,39055	14,49825	35
36	18,90828	17,66604	16,54685	15,53607	14,62098	36
37	19,14258	17,86224	16,71129	15,67400	14,73678	37
38	19,36786	18,04999	16,86789	15,80474	14,84602	38
39	19,58448	18,22965	17,01794	15,92866	14,94907	39
40	19,79277	18,40158	17,15909	16,04612	14,92640	40

TABLE V.

Rate p. cent.	half yearly payments.	quarterly payments.
3	1,007445	1,011181
$3\frac{1}{2}$	1,008675	1,013031
4	1,009902	1,014877
$4\frac{1}{2}$	1,011126	1,016720
5	1,012348	1,018559
$5\frac{1}{2}$	1,013567	1,020395
6	1,014781	1,022257
$6\frac{1}{2}$	1,015993	1,024055
7	1,017204	1,025880

CASE I.

The annuity, time, and rate per cent given, to find the amount;

RULE.

Involve the ratio to the time, and from the power subtract 1 for a dividend; which divide by the ratio, less 1; and multiply the quotient by the annuity, for the answer.
Or,

By table III. take the number under the rate, opposite the time, which multiply by the annuity.

For half yearly, or quarterly payments, the amount for years, multiplied by the corresponding number in Table V. will be the answer.

Table III. is calculated by the foregoing rule. And table V. thus: Take a unit from the ratio, also a unit from the square root of the ratio; $\frac{1}{2}$ the quotient of the first remainder, divided by the latter, will be the tabular number for half yearly payments. And for quarterly, use the 4th. root as above, and take $\frac{1}{4}$ of the quotient.

EXAMPLES.

1. What will an annuity of 60*l.* per annum, payable yearly, amount to in 4 years, at 6 per cent; and what are the respective amounts, at half yearly, and quarterly payments?

$$\overline{1.06}^4 = 1.26247696$$

$$1.06 - 1 = .06) .26247696$$

Table III. 4.374616

60

4.374616

60

£.262.47696 as before. yearly.

$$262.47696 = £.262 \ 9 \ 6\frac{1}{4}$$

$$262.47696 \times 1.014781 = £.266 \ 8 \ 9 \text{ half yearly.}$$

$$262.47696 \times 1.022257 = £.268 \ 6 \ 2\frac{1}{4} \text{ quarterly.}$$

2. What will 20£. a year, payable half yearly, amount to in 9 years, at 5 per cent per annum?

Answer.....£.223 5 1

3. What will an annuity of 320 dols. per annum, amount to in 20 years, at 6 per cent?

Answer.....11771 dols. 38 cents.

CASE 2.

The amount, rate, and time given, to find the annuity;

RULE.

Multiply the amount by the ratio, less 1, for a dividend; and the ratio involved to the time, less 1, for a divisor; the quotient will be the annuity. Or,

By table III; divide the amount by the number under the rate opposite the time.

For half yearly, or quarterly payments, divide the annuity by the proper number in table V.

EXAMPLES.

1. What annuity, forborn 4 years, at 6 per cent per annum, will amount to £.262.47696?

Amount 262.47696£.

$$1.06 - 1 = .06$$

$$\overline{1.06}^4 - 1 = .2624769) 15.7486176 (60 \text{ £. Answer.}$$

15 748614

36

Table III. 4.374616) 262.476960 (60£.

262.47696

00

2. What salary, payable half yearly, will amount to £.111 12 6 2.4, in 9 years, at 5 per cent?

Answer.....10£.

3. What annuity forborn 20 years, will amount to 5685dols. 70cts. at 6 per cent? Answer.....dols 160.

CASE. 3.

The annuity, amount, and rate given, to find the time ;

RULE.

Multiply the amount by the ratio, less 1 ; the product divide by the annuity, and to the quotient add 1 ; the sum will indicate the power : Then involve the ratio till it equals the power, which will indicate the time. Or,

By table II. under the rate, and opposite the power, is the time.

EXAMPLES.

1. In what time will 60£. per annum, payable yearly, amount to £.262,4769, at 6 per cent?

$$\begin{array}{r} \text{£.262.4769} \\ - 1.06 - 1 = .06 \end{array}$$

$$60 \overline{) 15.748614}$$

$$\text{quotient} + 1 = 1.2624769$$

$1.06^4 = 1.2624769 = 4\text{th power of the ratio, indicating 4 years, Answer.}$

By table II. under the rate, opposite 1.2624769, is 4 years.

2. In what time will a pension of £.50 per annum, amount to £.270 16 4 at 4 per cent?

Answer.....5 years.

3. In what time will a salary, of £.70 per annum amount to £.482 3 3½ at 5½ per cent? Answer.....6 years.

CASE 4.

The annuity, time, and rate given, to find the present worth;

RULE.

Divide the annuity by the ratio involved to the time, and subtract the quotient from the annuity : Divide the

remainder by the ratio, less 1, for the present worth.*
Or,

By table IV; multiply the number under the rate, and opposite the time, by the annuity.

When the payments are half-yearly, or quarterly, multiply the present worth found as above, by the proper number in table V.

EXAMPLES.

1. What ready money will purchase an annuity of £.60, to continue 4 years, at 6 per cent?

$$\frac{1.06^4}{1.06 - 1} = 1.2624769 \times 60 = 75.748614$$

$$1.06 - 1 = .06 \quad 12.4744$$

$$207.9066 = £.207 \text{ } 18 \text{ } 1\frac{1}{2} \text{ amount.}$$

By table IV. 3.4551

60

$$207.9060 = £.207 \text{ } 18 \text{ } 1\frac{1}{2}$$

2. What is the present worth of £.20 for 6 years, payable yearly, half-yearly, and quarterly; interest computed at 5 per cent?

Yearly £.101 10 3 $\frac{1}{4}$

Half do. 102 15 4

Quarterly 103 7 11 $\frac{1}{4}$

3. What is the present worth of an annuity of dls.320, to continue 20 years. at 6 per cent?

Answer.....3670 dols. 37 cents.

CASE 5.

The present worth, time, and rate given, to find the annuity;

RULE.

Multiply the present worth by the ratio involved to the time, and the product by the ratio, less 1, for a dividend; take a unit from the ratio involved to the time for a divisor, the quotient will be the annuity. Or,

* Table IV. is calculated by this rule.

By table IV : Divide the present worth, by the number for the rate and time.

For half-yearly, and quarterly payments, divide the annuity by the proper number in table V.

EXAMPLES.

1. What annuity, to continue 4 years, will £.207 18 1½ purchase, at 6 per cent ?

$$\begin{array}{r} \text{present worth } £.207.9066 \\ 1.06^4 = \quad - \quad - \quad 1.2624769 \end{array} \left. \vphantom{\begin{array}{r} \text{present worth } £.207.9066 \\ 1.06^4 = \quad - \quad - \quad 1.2624769 \end{array}} \right\} \text{multiply.}$$

$$\begin{array}{r} 262.47727 \\ 1.06 - 1 = .06 \end{array}$$

$$1.06^4 - 1 = .2624769 \quad 15.7486362 (60 \text{ } £. \text{ Answer.} \\ 15.748614$$

$$\begin{array}{r} \text{By table IV.} \quad 3.4651 \quad 207.9066 (60 \text{ } £. \\ 207.906 \\ \hline 06 \end{array}$$

2. What annuity, payable yearly, half-yearly, and quarterly, for 6 years, may be purchased for £.101 10 3¼, at 5 per cent ?

$$\begin{array}{l} 20 \text{ } £. \text{ yearly.} \\ 1.012348 \quad 20. (19 \text{ } 15 \text{ } 1\frac{1}{2} \text{ half yearly} \\ 1.018559 \quad 20. (19 \text{ } 12 \text{ } 3\frac{1}{4} \text{ quarterly.} \end{array}$$

3. What salary, to continue 20 years, will, dols. 1835 sts. 17 purchase, at 6 per cent ?

Answer.....160 dols.

CASE 6.

The annuity, present worth, and rate given, to find the time ;

RULE.

Multiply the present worth by the ratio, less 1, and subtract the product from the annuity ; then, divide the annuity by the remainder ; the quotient will be the power of the ratio, indicating the number of years. Or,

By table II; under the rate, and opposite the quotient, is the time.

EXAMPLES.

1. How long may an annuity of £60 per annum be purchased, for £.207.9066, at 6 per cent?

present worth £.207.9066:

$$1.06 - 1 = .06$$

$$\text{annu. } £.60 - 12.474396 = 47.525604$$

$$47.525604)60. = 1.262477$$

$$1.06 | = 1.2624769, \text{ indicating 4 years, Answer.}$$

2. How long may a lease of £.75 yearly rent, be had for £.533 1 8½, allowing 5 per cent to the purchaser?

Answer.....9 years.

3. A tenement is let for £.70 per annum, and the lessee makes present payment of £.245 7 2½, at 5½ per cent; for what time is the lease purchased?

Answer.....4 years.

ANNUITIES TAKEN IN REVERSION AT COMPOUND INTEREST.

ANNUITIES taken in reversion, are certain sums of money payable yearly for a limited period, but not to commence till after the expiration of a certain time.

CASE 1.

The annuity, time of reversion, time of continuance, and rate given, to find the present worth of the annuity in reversion;

RULE.

Divide the annuity by the power of the ratio for its continuance, and subtract the quotient from the annuity. Then involve the ratio to the time of reversion, and multiply the power by the ratio, less 1; the above remainder divided by the product, will give the present worth. Or,

By table IV: multiply the difference of the sum of the tabular numbers answering to the two periods, and that of the reversion, by the annuity, for the answer.

When half-yearly, and quarterly payments are considered, use table V. as before taught.

EXAMPLES.

1. What is the present worth of £.60, payable yearly, for 4 years, but not to commence till 2 years hence, at 6 per cent?

$$\begin{array}{r} \text{£.60 annuity.} \\ 1.06 \overline{) 1.2624769} = 1.2624769 \quad 60. (47.525463 \\ \text{1.06} \overline{) X.06} = .067416 \quad 12.474537 \quad (\text{£.185.038} = \\ \quad \quad \quad 67416 \\ \quad \quad \quad \text{---} \quad \quad \quad \text{£.185 0 9 Answer.} \\ \quad \quad \quad 573293 \text{ \&c} \quad \text{---} \end{array}$$

Table IV. 6 years = 4.91732

$$2 \quad - \quad = 1.83339$$

$$\text{---} \\ 3.08393$$

$$60$$

$$\text{---} \\ 185.03580$$

2. A tenement unfinished, is to be let for 8 years, at £.100 per annum, but cannot be completed till the end of 2 years; what is the present worth of such a lease, allowing 4 per cent for present payment?

Answer.....£.622 9 7

2. What is the present worth of a reversion of a lease of dols. 160 per annum, to continue 20 years, but not to commence till the end of 8 years, allowing 6 per cent to the purchaser?

Answer.....dols.1151 cts.4k

CASE 2.

The present worth, times, and rate given, to find the annuity;

RULE.

Involve the ratio to the years from the time of purchase, to the expiration of the annuity, for a dividend; and from the ratio, involved to the time of continuance, take one, for a divisor; the quotient multiplied by the present worth, and that product by the ratio, less 1, gives the annuity. Or,

By table IV, take the difference, as in the last case, by which divide the present worth.

EXAMPLES.

1. What annuity, to be entered upon 2 years hence, and then to continue 4 years, may be purchased for £.185 0 8½ at 6 per cent

$$1.06\overline{)}^6 = 1.4118519$$

$$1.06\overline{)}^4 - 1 = .2624769) 1.4118519 (5.4043 \text{ quo.}$$

$$5.4043 \times 185.0387 \times .06 = \text{£.60 Answer.}$$

Table IV. $\begin{cases} 6 \text{ years} = 4.91731 \\ 2 \text{ - } = 1.83339 \end{cases}$

$$\begin{array}{r} 3.08392) 185.0354 (60 \text{ £.} \\ \underline{185 \ 0352} \\ 2 \end{array}$$

2. The present payment for the lease of a house is £.622 9 7½, the lease to commence two years hence, and to continue eight years; how much is the yearly rent, when four per cent is allowed for present money?

Answer.....£.100.

3. The present worth of a lease of an house is dols. 1151 42 cts. taken in reversion for 20 years, but not to commence till the end of 2 years; what is the yearly rent, allowing six per cent to the purchaser?

Answer.....Dols. 160.

CASE 3.

The present worth, annuity, rate, and time of reversion given, to find the time of continuance;

RULE.

Involve the ratio to the time of reversion; multiply the power by the ratio, less 1, and by the annuity; the product subtract from the annuity; then, divide the an-

nuity by the remainder, for the power of the ratio, indicating the time. Or,

By table II. find the power under the rate, and opposite is the time.

EXAMPLES.

1. A lease of £.60 per annum, to commence two years hence, is worth £.185 0 8½ ready money; for what time must it continue, when 6 per cent per annum is allowed to the purchaser?

$$\begin{array}{r} 1.06^2 = 1.1236 \\ 1.06 - 1 = .06 \\ \hline .067416 \times 185.0354 = 12.4743465 \\ \hline 47.5256535 \end{array}$$

$$47.5256535)^{60} (1.262476$$

$$1.06^4 = 1.262476 = 4 \text{ years. Answer.}$$

Table II. 1.262476 under 6, and opposite, is 4 years.

2. For a lease of £.160 per annum, but not to commence till the expiration of 4 years, £.761 13 6½ the present worth, at 5 per cent, is paid down by the purchaser; how long is he to possess the premises?

Answer.....7 years.

3. The yearly rent of £.400, to commence 2 years hence, is sold at 4 per cent. for £.2489 18 6; how long does the purchaser hold it?

Answer.....8 years.

PERPETUITIES AT COMPOUND INTEREST.

PERPETUITIES are such annuities as continue forever.

CASE 1.

The annuity, and rate given, to find the present worth ;

RULE.

Divide the annuity by the ratio, less 1, and the quotient will be the present worth.

When perpetual half-yearly, or quarterly payments are to be considered, use table V, as taught in temporary annuities.

EXAMPLES.

1. What is the value of a freehold estate of 60*£*. per annum, allowing 6 per cent to the purchaser ? And what half-yearly, and quarterly ?

$$1.06 - 1 = .06) 60.00 (\text{£}.1000 \text{ yearly.}$$

6

000

$$1000 \times 1.014781 = 1017 \text{ } 16 \text{ } 9\frac{1}{2} \text{ half yearly.}$$

$$1000 \times 1.022257 = 1022 \text{ } 5 \text{ } 1\frac{1}{2} \text{ quarterly.}$$

2. An estate brings in annually dols. 200 ; what should it sell for, allowing the purchaser 5 per cent ?

Answer.....4000 dollars.

CASE 2.

The present worth and rate given, to find the annuity ;

RULE.

Multiply the present worth by the ratio, less 1, and the product will be the annuity.

EXAMPLES.

1. A freehold estate, bought for *£*.1000 ready money, at 6 per cent, what is the annuity ?

$$\begin{array}{r} \text{£.} \\ 1000 \\ 1.06 - 1 = .06 \end{array}$$

Answer.....£.60.00

2. An estate is sold for dols.9666 60cts. present money, and 4 per cent allowed to the buyer, how much is the income per annum? Answer.....dols.386 66cts.

CASE 3.

The present worth, and annuity given, to find the rate;

RULE.

Divide the sum of the present worth and annuity, by the present worth, and the quotient will be the ratio.

EXAMPLES.

1. If a real estate of £.60 per annum be sold for £-1000, what rate of interest was allowed to the purchaser for his money?

$$\begin{array}{r} \text{£.} \\ 1000 \\ 60 \\ \hline \text{ratio.} \\ 1000)1060(1.06 = \text{£.6 per cent Answer.} \\ 1000 \\ \hline 6000 \\ 6000 \\ \hline \end{array}$$

2. If a freehold estate of dols.773 34cts. per annum, be bought for dols.19333 34cts, what rate of interest had the purchaser for his money? Answer.....4 per cent.

CASE 4.

The rate per cent given, to find the number of years purchase;

RULE.

Divide 100 by the rate, and the quotient will be the answer.

EXAMPLES.

1. How many years purchase should be offered for an estate, to have 5 per cent for the purchase money?

$$\begin{array}{r} \text{£.} \\ 5 \overline{)100} \\ \hline \end{array}$$

Answer.....20 years.

2. In selling a freehold estate at 8 per cent, how many years purchase does it bring?

Answer.....12½ years.

CASE 5.

The number of years purchase, at which an estate is bought or sold, given, to find the rate;

RULE.

Divide 100 by the number of years, and the quotient will be the rate.

EXAMPLES.

1. Bought a ground rent for 20 years purchase; what rate per cent was allowed in this contract?

$$\begin{array}{r} \text{£.} \quad \text{£.} \\ 20 \overline{)100} \quad (5 \text{ per cent, Answer.} \\ 100 \\ \hline 0 \end{array}$$

2. A yearly income being sold for 15 years purchase; what rate of interest was it?

Answer.....6⅔ per cent.

PERPETUITIES IN REVERSION.

PERPETUITIES in reversion are rents of estates payable yearly, which are to continue forever, after the extinction of a life which is calculated to continue a given time.

CASE 1.

The rent of a freehold estate, time of reversion, and rate per cent given, to find the present worth ;

RULE.

Multiply the ratio, involved to the time of reversion, by the ratio, less one, for a divisor ; by which divide the yearly payment, the quotient will be the answer.

EXAMPLES.

1. If a freehold estate of £120 per annum, to commence 2 years hence, be sold ; what is the value, allowing the purchaser 6 per cent ?

$$\begin{array}{r} \overset{2}{1.06} \overline{) 1.1236} \\ 1.06 \text{ --- } 1 = .06 \end{array}$$

$$\text{--- } \text{£.} \\ .067416) 120. (\text{£.1779 19 10}\frac{1}{2} \text{ Answer.}$$

2. An estate of dols. 385 67cts. per annum, to continue forever, but not to commence till the expiration of 4 years, what is it worth in present money, allowing the purchaser 4 per cent ?

Answer.....dols. 6263 17cts.

CASE 2.

The present worth of a perpetuity, time of its reversion, and rate given, to find the yearly payment ;

RULE.

Multiply the present worth, the ratio involved to the time of reversion, and the ratio, less 1, for the answer.

1. A freehold estate is bought for £.1779.99288, which does not commence till the end of 3 years; the purchaser being allowed 6 per cent for his money, what was the yearly income?

$$\begin{array}{r} \text{£.} \\ 1779.99288 \end{array} \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{multiply.} \\ 1.06 \overline{)} \text{ inverted} = \begin{array}{r} 6821.1 \\ \hline 2000.00000 \\ .06 \end{array}$$

£.120. Answer.

2. There is a freehold estate, purchased for dols.33052 43cts. which does not commence till the expiration of 4 years; the buyer was allowed 4 per cent for his money; what was the yearly income?

Answer.....dols.1546 66cts.

LIFE ANNUITIES.

LIFE annuities are estimated from the probable duration of human life, as taken from the bills of mortality.

Construction of the following table.

Subtract the given age from 86; and take the number, in Table IV, under the given rate, opposite the remainder: Multiply this number by the ratio, and subtract the product from the said remainder; the last remainder divide by the product of the first remainder with the ratio, less 1, for the tabular number.

TABLE VI.
Value of 1*l*. annuity, for a single life.

Age.	3 p.ct.	3½ p.ct.	4 p.ct.	4½ p.ct.	5 p.ct.	6 p.ct.
9 or 10	19,87	18,27	16,88	15,67	14,60	12,80
8 or 11	19,74	18,16	16,79	15,59	14,53	12,75
7 or 12	19,60	18,05	16,64	15,51	14,47	12,70
13	19,47	17,94	16,60	15,43	14,41	12,65
6 or 14	19,33	17,82	16,50	15,35	14,34	12,60
15	19,19	17,71	16,41	15,27	14,27	12,55
16	19,05	17,59	16,31	15,19	14,20	12,50
5 or 17	18,90	17,46	16,21	15,10	14,12	12,45
18	18,76	17,33	16,10	15,01	14,05	12,40
19	18,61	17,21	15,99	14,92	13,97	12,35
4 or 20	18,46	17,09	15,89	14,83	13,89	12,30
21	18,30	16,96	15,78	14,73	13,81	12,20
22	18,15	16,83	15,67	14,64	13,72	12,15
23	17,99	16,69	15,55	14,54	13,64	12,10
3 or 24	17,83	16,56	15,43	14,44	13,55	12,00
25	17,66	16,42	15,31	14,34	13,46	11,95
26	17,50	16,28	15,19	14,23	13,37	11,90
27	17,33	16,13	15,04	14,12	13,28	11,80
28	17,16	15,98	14,94	14,02	13,18	11,75
29	16,98	15,83	14,81	13,90	13,09	11,65
30	16,80	15,68	14,68	13,79	12,99	11,60
2 or 31	16,62	15,53	14,54	13,67	12,88	11,50
32	16,44	15,37	14,41	13,55	12,78	11,40
33	16,26	15,05	14,12	13,30	12,56	11,25
34	16,06	14,71	13,8	13,04	12,33	11,05
35	15,29	14,34	13,52	12,77	12,09	10,90
1 or 36	15,05	14,16	13,36	12,63	11,96	10,80
37	14,84	13,98	13,20	12,48	11,83	10,70
38	14,41	13,59	12,85	12,18	11,57	10,45
39	13,96	13,20	12,50	11,87	11,29	10,25
40	13,49	12,78	12,13	11,54	10,99	10,00
41	13,01	12,36	11,74	11,19	10,68	9,75
42	12,51	11,92	11,34	10,82	10,35	9,45
43	12,00	11,45	10,92	10,44	9,99	9,20
44	11,46	10,95	10,47	10,04	9,63	8,85
45	10,90	10,44	10,01	9,61	9,24	8,55
46	10,32	9,91	9,52	9,16	8,83	8,20
47	9,73	9,36	9,01	8,69	8,39	7,80
48	9,11	8,79	8,48	8,19	7,93	7,40
49	8,46	8,19	7,92	7,67	7,43	6,95
50	7,79	7,56	7,33	7,12	6,91	6,50
51	7,10	6,91	6,75	6,54	6,36	6,00
52	6,38	6,22	6,06	5,92	5,77	5,50
53	5,63	5,51	5,38	5,26	5,15	4,90
54	4,85	4,77	4,65	4,57	4,49	4,30
55	4,05	3,98	3,91	3,84	3,78	3,65
56	3,21	3,16	3,11	3,07	3,03	2,95
57	2,34	2,31	2,28	2,26	2,23	2,15

Example. Find the tabular number for 50 years, at 6 per cent.

$$\begin{array}{r}
 36 \\
 1.06 - 1 = .06 \\
 \hline
 2.16
 \end{array}
 \qquad
 \begin{array}{r}
 86 \\
 50 \\
 \hline
 36 = 14.62098 \text{ Table IV.} \\
 1.06 \\
 \hline
 8772588 \\
 14620980 \\
 \hline
 36 - 15.4982388 = \\
 2.16) 20.5017612 (9.49 \text{ tab. num.} \\
 19 \ 44 \\
 \hline
 10 \ 61 \ \&c.
 \end{array}$$

CASE 1.

Given the age of a single life, to find the present worth of an annuity :

RULE.

The value of $\text{£}1$, for the given age and rate, multiplied by the annuity, will give the present worth.

EXAMPLES.

1. What sum should a person of 80 years of age give, for an annuity of $\text{£}100$ per annum, during his life, interest computed at 6 per cent ?

$$\begin{array}{r}
 \text{Table VI. age 80, rate 6} = 2.15 \\
 \text{annuity} \quad \quad \quad = 100
 \end{array}$$

$\text{£}215.00$ Answer.

2. What is the present worth of $\text{£}800$ per annum, to commence at the decease of a person who is now 60 years of age, and to continue forever after, interest at 5 per cent ?

$$\begin{array}{r}
 8.39 \\
 800 \\
 \hline
 \text{£.6712.00 during life.} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 1.06 - 1 = .05) 800.00 \\
 \hline
 16000 \text{ forever.} \\
 6712 \\
 \hline
 \text{£.9288 Answer.} \\
 \hline
 \end{array}$$

3. A person of 40 years of age, would sell an annuity worth dols. 133 $\frac{1}{3}$ per annum; what is its value, at 4 $\frac{1}{2}$ per cent?

Answer.....dols. 1664.

CASE 2.

Given two lives, one failing, the annuity to cease, to find the joint value of the annuity;

RULE.

The product of the numbers, corresponding with the ages, multiply by the ratio, less 1; this last product subtract from the sum of said numbers for a divisor: Multiply the first product by the annuity for a dividend; the quotient will be the answer.

EXAMPLES.

1. What is the value of £.80 annuity, for the joint lives of two persons, one of 36, and the other 48 years of age, computing interest at 6 per cent?

$$\begin{array}{l}
 36 = 11.05 \\
 48 = 9.75
 \end{array}
 \left. \vphantom{\begin{array}{l} 36 \\ 48 \end{array}} \right\} = 20.80$$

$$\begin{array}{r}
 5525 \\
 7735 \\
 9945 \\
 \hline
 6.46425 \\
 \hline
 14.33575 \text{ divisor.}
 \end{array}$$

$$\begin{array}{r}
 107.7375 \times 80 = 8619.0000 (612 \text{ \& 10 Answer.} \\
 .06 \qquad \qquad \qquad 8601450 \\
 \hline
 6.464250 \qquad \qquad \qquad 175300 \text{ \&c.} \\
 \hline
 \end{array}$$

2. What is dols. 800 annuity worth, for the joint lives of two persons, age 60 each, at 4 $\frac{1}{2}$ per cent?

Answer.....dols. 4320 83cts.

CASE 3.

Given two lives, the annuity to continue to the death of the longest liver, to find its value ;

RULE.

From the sum of the value of the single lives, take that of the joint lives ; the remainder will be the answer.

EXAMPLES.

1. What is the value of an annuity of £.90, for the longest life of two persons, aged 50 and 60 years, interest at 5 per cent ?

$$50 = 10.35$$

$$60 = 8.39$$

$$\hline$$

$$18.74 \text{ joint lives} = 542.79 \text{ Case 2.}$$

$$90$$

$$\hline$$

$$1686.60$$

£.

$$1686.6$$

$$\hline \text{£.1143.81 Answer.}$$

$$\hline$$

2. What is dols. 800 annuity worth at 4 per cent, to continue during the longest life of two persons, whose ages are 30 and 40 years? Answer.....dols.14608

CASE 4.

To find the value of an annuity for the time, which a person of a given age may happen to survive another, whose age is also given ;

RULE.

From the value of £.1 for the proposed successor's life, subtract the value thereof for his and the possessor's joint lives, and multiply the remainder by the annuity, for the present worth.

EXAMPLES.

1. P has an income of £.100 per annum ; and Q would purchase it for his life after P's death : What is Q's chance worth, computing interest at 5 per cent ; their ages being, P 60, and Q 25 ?

Q 25 - - - = 13.46

joint value of $\text{£}6.97$ Case 2nd.6.49

100

 $\text{£}6.49.00$ Answer.

2. A widow of 54 years of age, possesses an annuity of $\text{dols.}160$ per annum clear, which, at her death, goes to her son, who is now 25 : If he shall then be living, what is the value of his expectation, at 5 per cent ?

Answer..... $\text{dols.}905\ 60\text{cts.}$

DUODECIMALS.

DUODECIMALS are fractions of a foot, or of an inch, &c. having 12 for their denominator.

By this rule may be computed all the works of artificers that are measured by feet and inches.

THE DENOMINATIONS.

12 fourths "" make 1 third, ""

12 thirds.....1 second, ""

12 seconds.....1 inch, in.

12 inches.....1 foot, ft.

ADDITION.

RULE.

Add as in compound addition, and carry 1 for every 12.

feet	in.	"	""	""	feet	in.	"	""	""
21	10	4	5	6	174	10	4	5	8
78	1	7	6	6	825	1	7	6	4
41	9	6	4	9	365	8	6	9	3
58	2	5	7	3	634	3	5	2	9
98	11	8	9	6	743	9	11	10	7
21	6	11	10	4	258	11	10	8	11

SUBTRACTION.

RULE.

As in compound subtraction, taking from 12 when necessary.

EXAMPLES.

feet	in.	"	'''	''''	feet	in.	"	'''	''''
48	10	2	6	5	476	9	2	10	5
19	6	3	4	9	182	11	0	9	8

MULTIPLICATION ;

COMMONLY CALLED CROSS MULTIPLICATION.

CASE 1.

When the feet of the multiplier do not exceed 12, or, when they are the exact product of two factors in the multiplication table ;

RULE.

Set the highest figure of the multiplier under the lowest one of the multiplicand ; multiply, and carry 1 for every 12 to the product of the next denomination ; setting down the first remainder under its respective multiplier.

If solidity be considered, multiply the superficial content by the thickness.

Feet multiplied by feet, give feet.

Feet multiplied by inches, give inches.

Feet multiplied by seconds, give seconds.

Inches multiplied by inches, give seconds.

Inches multiplied by seconds, give thirds.

Seconds multiplied by seconds, give fourths.

PROOF.

Divide the product of the inches by 144 ; or, take aliquot parts ; otherwise prove by vulgar or decimal fractions.

EXAMPLES.

f. in.
multiply 9 7
by 3 6

4 9 6
28 9

Facit..33 6 6

f. in. in.
9 7=115
3 6=42

230
460

144 { 12 | 4830
12 | 402 6

feet 33 6 6 Proof.

f. in. "
mul. 8 6 9
by 7 3 8

5 8 6 0
2 1 8 3
59 11 3

Facit..62 6 7 9

in. f. in. "
3=1 8 6 9
4 7

" 59 11 3
6=1 2 1 8 3
8 2 4 3 4 6
3 1 5 1 6

62 6 7 9 proof

ft. in.
multiply 42 9
by 24 6

product 1047 4 6

By vul. frac.

$42\frac{9}{12} = \frac{513}{12} = 17\frac{9}{4}$

$24\frac{6}{12} = \frac{294}{12} = 24\frac{6}{12}$

$17\frac{9}{4} \times 24\frac{6}{12} = 1047\frac{4}{1} = 1047\frac{4}{1}$

feet.in."

By decim.

42. 9=42.75

24. 6=24.5

feet 1047.375

} multiply.

12

in. 4.5

12

" 6.0

A piece of timber :

	f.	in.
length	12	9
breadth	3	8

	45	9	0
thickness	2	10	

solidity ft. 132 5 6

Bale of goods.

	f.	in.
length	5	10
breadth	4	6

	26	3	0
thickness	3	10	

solid. ft. 100 7 6

CASE 3.

When the feet of the multiplier exceed 12, and are not the product of two factors ;

RULE.

Multiply by the feet, as directed in case 2, Compound Multiplication, and take parts for the inches, &c.

EXAMPLES.

	ft.	in.	"		ft.	in.	"
Multiply	92	1	7		92	1	7
	$7 \times 10 + 1 = 71$				71	3	6
	<hr/>				<hr/>		
	644	11	1		3	10	0 9 6
		10			23	0	4 9
	<hr/>				6541	4	5
in.	6449	2	10		<hr/>		
$3 = \frac{1}{4}$	92	1	7	feet	6568	2	10 6 6 Pr.
$6 = \frac{1}{8}$	23	0	4 9		<hr/>		
	3	10	0 9 6		<hr/>		
	<hr/>				<hr/>		
Facit.....	6568	2	10 6 6				

	ft.	in.	"		ft.	in.	"
Mul.	311	4	7	Mul.	487	11	10
by	ft. 36	7	5	by	ft. 186	10	11
	<hr/>				<hr/>		
Product..	11402	2	4 11 11		91209	4	2 2 2
	<hr/>				<hr/>		

A piece of Mahogany.					Bale of goods.						
	ft.	in.	"			ft.	in.	"			
length	14	6	4		length	7	6	4			
breadth		ft.	3	4	6	breadth	ft.	4	3	6	
superf.	48	11	4	6	superf.	33	3	8	2		
thickness		ft.	2	6	4	thickness	ft.	3	4	6	
solidi. ft.	123	8	9	0	6	solid.	109	0	5	0	9

PRACTICAL QUESTIONS.

1. Four floors in a certain building contain each 1084ft. 8in. 8"; how many feet are there in all?

Answer.....4339ft. 2in. 8"

2. Six boards measure as follows; viz. 27ft. 3in. 25ft. 11in. 23ft. 10in. 20ft. 9in. 20ft. 6in. and 18ft. 5in. how many feet do they contain?

Answer.....136ft. 8in.

3. From a board measuring 29ft. 4in. 8", cut 21ft. 10in. 9", and what remains?

Answer.....17ft. 5in. 11"

4. Bought a raft of boards, containing 59621ft. 8in. of which were sold three parcels, each 14905ft. 5in. how many feet were remaining? Answer.....14905ft. 5in.

5. A mahogany board is 23ft. 3in. long, and 3ft. 6in. wide; how many feet does it contain?

Answer.....81ft. 4in. 6"

6. A piece of walnut is 6ft. 3in. 6" long, and 2ft. 3in. 6" wide; required its content?

Answer.....14ft. 5in. 4"

7. A partition is 82ft. 6in. by 13ft. 3in. how many yards of yard wide paper will cover it?

Answer.....121yds. 4ft. 1in. 6"

8. If a ceiling be 69½ feet in length, and 24½ feet in breadth; how many square yards are there?

Answer.....162yds. 5ft. 10in. 6"

9. A garden walk of 64.5 feet in length, and 17.5 in breadth, is to be paved with stones of 18 inches square; what number are necessary for the purpose?

Answer.....501 ½

10. A walk of 82 yards in length, and 22 feet in breadth, is to be paved with bricks of 9 inches by $4\frac{1}{2}$; query the number necessary? Answer.....19242+

11. A room measures 180 feet about; its height is 10 f. 9 in. the ceiling 50 feet by 40; what will the plasterer's bill come to, at 11 cents the yard?

Answer.....dols. 48 09cts.

12. A room is 109 ft. 9 in. within walls, and 9 ft. 3 in. high, which is (excepting two windows each 6 ft. 6 in. by 5 ft. 9 in.) to be hung with ell wide tapestry; how many yards are required? Answer.....83.5+yards

13. A board is 2 ft. 11 in. at the wide end, and 2 ft. 5 in. at the other; its length 25 ft. 10 in. how many feet does it contain? Answer.....66 ft. 10 in. 8"

OF CARPENTER'S AND MASON'S WORK.

CARPENTERS compute flooring, roofing, &c. by the square of 100 feet. Bricks are laid by the 1000; and stone work is measured by the standard perch of $1\frac{1}{2}$ foot thick, and 1 foot deep.

CARPENTER'S WORK.

FLOORING AND ROOFING.

The content of floors, and regular square timber, is found by the previous cases; and roofing is measured by the square on the surface of the slope, as flooring.

SQUARE TIMBER, OF UNEQUAL BASES.

2 Multiply the side in inches of the greater base by those of the less, and to the product, add $\frac{1}{3}$ of the square of the difference of the sides: This sum multiply by the length, and divide the product by 144, if the length be taken in feet.

PARALLEL ROUND TIMBER.

Multiply the square of the diameter in inches by .7854 and by the length continually; which product divide by 144.

ROUND TIMBER OF UNEQUAL BASES.

Multiply the greater diameter by the less, and to the product add $\frac{1}{3}$ of the square of their difference. This sum multiply by .7854, and by the length continually, and divide by 144.

MASON'S WORK.

Multiply the length, breadth and thickness continually, and divide the product by 24.75 (which is $16.5 + 8.25$) for the content in perches. Or,

Find the content at the standard thickness, and take parts for the overplus, if any.

If the wall be of the standard thickness, multiplying by the thickness may be omitted; dividing, in that case, by 16.5.

EXAMPLES.

1. A room is 53ft. 6in. in length, and 47ft. 9in. in breadth; how many squares are in the floor?

Answer.....25sq 54f. $\frac{1}{2}$

2. The roof of a building is 78 feet 9 inches in length, and 68 feet 3 inches in breadth on the surface; how many squares are there? Answer.....53sq. 74 feet.

3. The side of a square piece of timber is 18 inches at one end, and 12 at the other, and its length 18 feet; required the solid content? Ans.....28.5feet.

4. The diameter of a round piece of timber is $21\frac{1}{2}$ inc. and its length 32 feet; the solidity is required?

Answer.....feet80.6 $\frac{1}{2}$

5. A round piece of timber is 18 inches diameter at one end, and 9 at the other, the length $28\frac{1}{2}$ feet; required the solid content? Answer.....feet29.3 $\frac{1}{2}$

6. A pile of stone is 127ft. 10in. long, 48 ft. 9in. wide, and 4ft. 4in. high; how many perches does it contain?

Answer.....1091 $\frac{1}{2}$ perch

7. A pile of stone is 84ft. 6in. in length, and 27ft. 10in. wide at one end, and at the other 14ft. 8in. and parallel with the other end; its height 5ft. 4in. how many perches are there? Answer.....386.9 per.

8. A cellar wall of the standard thickness, measures from out to out 47ft. 9in. within, 28ft. 5in. its height 8ft. 8in.; query the number of perches? Ans...52.3 per.

9. The stone work of a certain building measures as follows: Side walls each 102ft. 9in. ends 86ft. 3in. thickness of each 2ft. 3in. two partition walls, one 86ft. 3in. by 15in. the other 57ft. 8in. by 12in. and all 7ft. 9in. high; how many perches are contained in the whole?

Answer.....318 $\frac{1}{2}$

GAUGING.

GAUGING is the art, which teaches to ascertain the number of gallons, or bushels, contained in any vessel.

The standard gallon, for the measurement of liquids, contains 231 cubic inches; and a bushel, for that of grain, 2150.42 cubic inches.

If the diameter of a circle be 1, the area of that circle will be .785398; which, divided by 231, gives .0034 nearly; and divided by 2150.42, quotes .000365: which numbers are multipliers for circular vessels; the former for gallons, the latter for bushels. Also.

If 231 be divided by .785398, the quotient will be 294.12; and 2150.42, divided by the same number, quotes 2738: which quotients are divisors for like vessels for gallons and bushels. Hence the following general rules for square or circular vessels.

FOR SQUARE VESSELS.

Divide the cubic inches, contained in any vessel, by the cubic inches contained in a gallon, or bushel; the quotient will be the gallons, or bushels.

FOR CIRCULAR VESSELS.

The square of the diameter multiplied by the preceding multipliers, or divided by the preceding divisors, will give the content in gallons or bushels respectively, at one inch deep; which, multiplied by the vessel's depth, will give the whole content in gallons, or bushels.

NOTE. The dimensions of vessels are always to be taken in inches, and decimal parts of an inch.

CASE I.

To find the content of a cubic vessel, or of a parallelopipedon;

RULE.

Multiply the length in inches by the breadth, and that product by the depth; the last product will be the content in cubic inches; which reduce to gallons, or bushels.

EXAMPLES.

1. What is the content in gallons of a cubic vessel, the side of which is 79 inches?

$$79 \times 79 \times 79 = 493039 \text{ galls.}$$

$$231) 493039 (2134 \text{ Answer.}$$

$$462$$

310 &c.

2. What is the content in gallons of a brewer's cooler, the length 14ft. 10in. breadth 7ft. 4in. and the depth 12 inches? Also how many barrels will it hold?

$$231) 31.5$$

$$178 \times 88 \times 12 = 187968 (813.7 \text{ gallons.}$$

$$1848$$

$$25.8 \text{ barrels.}$$

316 &c.

3. A granary is 6ft. 10in. in length, 4ft. 6in. in breadth, and 3ft. 4in. deep; how many bushels of grain will it contain? Answer.....82.3 + bushels

CASE 2.

To find the content of a vessel, the bases of which are parallel, but unequal;

RULE.

Find the areas of each base separately; the square root of the product of these areas, add to their sum; this last sum, multiply by $\frac{1}{3}$ of the vessels' depth; for the content in inches; which reduce to gallons or bushels.

EXAMPLES.

1. Suppose a reservoir, the length of the greater base 100 inches, the lesser base 80 inches; length and breadth at top 70 and 56 inches, and depth $3\frac{1}{2}$ feet; how many gallons will it contain, also how many hogheads?

$$\begin{array}{l} 100 \times 80 = 8000 \\ 70 \times 56 = 3920 \end{array} \left. \vphantom{\begin{array}{l} 100 \times 80 = 8000 \\ 70 \times 56 = 3920 \end{array}} \right\} = 11920 \quad 3920 \times 8000 = 31360000$$

$$\sqrt{31360000} = 5600$$

$$\begin{array}{r} 17520 \\ \text{ft. } 3\frac{1}{2} = 42 \div 3 = 14 \end{array} \left. \vphantom{\begin{array}{r} 17520 \\ 14 \end{array}} \right\} \text{multiply}$$

$$63)$$

$$231) 245280 (1061 \text{ gallons}$$

$$\text{hhd. } 16 \text{ } 53 \text{ gallons.}$$

2. A corn crib is 25 feet in length at bottom, and 4 ft. 2 in. wide, 28 feet at top, and 5 ft. wide; its height $7\frac{1}{2}$ feet: how many bushels will it contain?

Answer.....733 bush.

CASE 3.

To find the content of a cylinder;

RULE.

The square of the diameter, multiplied by .0034, or divided by 294.12, for gallons; also said square multiplied by .000365; or divided by 2738; for bushels, will give the content of one inch, which multiply by the vessels' depth for the answer.

EXAMPLES.

1. What is the content in gallons of a cylindrical vessel, the diameter of which is 48 inches, and length 5 feet?

$$48 \times 48 \times .0034 \times 60 = 470 \text{ gallons, Answer.}$$

$$\text{and, } 48 \times 48 \div 294.12 \times 60 = 470, \text{ as before.}$$

2. A cylindrical vessel is 6 feet in diameter, height 5 ft. 10 in. query its content in gallons, also in bushels?

$$\text{Answer.....} \begin{cases} 1233 \text{ gallons.} \\ 132 \text{ bushels.} \end{cases}$$

CASE 4.

To find the content of a vessel, the diameters parallel, but unequal.

RULE.

To the product of the greater diameter by the less, add $\frac{1}{3}$ of the square of their difference for the square of the mean diameter: Then proceed as in the last case.

EXAMPLES.

1. If the diameters of a vessel be 83, and 77 inches, and depth 44.5 inches; how many gallons does it contain?

$$83 - 77 \times 6 \div 3 = 12$$

$$83 \times 77 + 12 \times .0034 \times 44.5 = 968 \text{ gallons.}$$

2. Required the content in gallons of a cistern, the diameters 48, and 40 inches, and height 5 feet? Also the number of bushels it will hold?

Answer..... { 396 gallons
 { 42½ bush.

CASE 5.

To find the content of a barrel, hogshead, pipe, &c.

RULE.

The difference between the head and bung diameters, multiply by .7, by .69, by .6, or by .55, according as the cask is more or less arching, and to the product, add the head diameter, for the equated diameter; then proceed as directed in case 3. Or,

Seek for the difference in Table I, against inches; and according to the form of the cask, the inches and parts under such difference, add to the head diameter, for the equated diameter. Or,

By table II. multiply the sum of the tabular numbers, answering to the given diameters, by the length of the vessel.

By this table, the content of a cylinder may also be obtained.

TABLE I.

Inches	2	3	4	5	6	7	8
	•	•	•	•	•	•	•
1st form	1	2	3	4	5	6	7
com. do.	1	2	3	4	5	6	7
least do.	1	2	3	4	5	6	7

TABLE II.

ln.	hd.	bu.	ln.	hd.	bu.	ln.	hd.	bu.	ln.	hd.	bu.
6	.05	.07	16	.34	.53	26	.89	1.40	36	1.71	2.69
$\frac{1}{4}$	.05	.08	$\frac{1}{4}$	.35	.54	$\frac{1}{4}$	.91	1.43	$\frac{1}{4}$	1.74	2.72
$\frac{1}{2}$	.06	.08	$\frac{1}{2}$	.36	.56	$\frac{1}{2}$	.92	1.46	$\frac{1}{2}$	1.76	2.76
$\frac{3}{4}$	.06	.09	$\frac{3}{4}$	.37	.58	$\frac{3}{4}$	.94	1.49	$\frac{3}{4}$	1.79	2.80
7	.07	.10	17	.38	.60	27	.96	1.51	37	1.81	2.84
$\frac{1}{4}$	.07	.11	$\frac{1}{4}$	.39	.62	$\frac{1}{4}$	.98	1.54	$\frac{1}{4}$	1.84	2.88
$\frac{1}{2}$	.08	.11	$\frac{1}{2}$	.40	.64	$\frac{1}{2}$	1.00	1.57	$\frac{1}{2}$	1.86	2.92
$\frac{3}{4}$	.08	.12	$\frac{3}{4}$	.41	.66	$\frac{3}{4}$	1.02	1.60	$\frac{3}{4}$	1.89	2.96
8	.09	.13	18	.43	.67	28	1.04	1.63	38	1.91	3.00
$\frac{1}{4}$	.09	.14	$\frac{1}{4}$	.44	.69	$\frac{1}{4}$	1.05	1.66	$\frac{1}{4}$	1.94	3.04
$\frac{1}{2}$	.10	.14	$\frac{1}{2}$	.45	.71	$\frac{1}{2}$	1.07	1.69	$\frac{1}{2}$	1.96	3.08
$\frac{3}{4}$	.10	.15	$\frac{3}{4}$	.46	.73	$\frac{3}{4}$	1.09	1.72	$\frac{3}{4}$	1.99	3.12
9	.11	.16	19	.48	.75	29	1.11	1.75	39	2.01	3.16
$\frac{1}{4}$	.12	.17	$\frac{1}{4}$	.49	.77	$\frac{1}{4}$	1.13	1.78	$\frac{1}{4}$	2.03	3.20
$\frac{1}{2}$	.12	.18	$\frac{1}{2}$	.50	.79	$\frac{1}{2}$	1.15	1.81	$\frac{1}{2}$	2.06	3.24
$\frac{3}{4}$	.13	.19	$\frac{3}{4}$	.51	.81	$\frac{3}{4}$	1.17	1.84	$\frac{3}{4}$	2.08	3.28
10	.14	.20	20	.53	.83	30	1.19	1.87	40	2.11	3.32
$\frac{1}{4}$	.14	.21	$\frac{1}{4}$	.55	.85	$\frac{1}{4}$	1.21	1.90	$\frac{1}{4}$	2.13	3.36
$\frac{1}{2}$	.15	.22	$\frac{1}{2}$	.56	.87	$\frac{1}{2}$	1.23	1.93	$\frac{1}{2}$	2.16	3.40
$\frac{3}{4}$	.16	.23	$\frac{3}{4}$	.57	.89	$\frac{3}{4}$	1.25	1.96	$\frac{3}{4}$	2.19	3.44
11	.17	.24	21	.58	.92	31	1.27	2.00	41	2.22	3.49
$\frac{1}{4}$	.17	.26	$\frac{1}{4}$	.59	.94	$\frac{1}{4}$	1.29	2.03	$\frac{1}{4}$	2.24	3.53
$\frac{1}{2}$	.18	.27	$\frac{1}{2}$	.61	.96	$\frac{1}{2}$	1.31	2.06	$\frac{1}{2}$	2.27	3.58
$\frac{3}{4}$	.18	.29	$\frac{3}{4}$	.62	.99	$\frac{3}{4}$	1.33	2.09	$\frac{3}{4}$	2.30	3.62
12	.19	.30	22	.64	1.01	32	1.35	2.13	42	2.33	3.67
$\frac{1}{4}$	.20	.31	$\frac{1}{4}$	.65	1.03	$\frac{1}{4}$	1.37	2.17	$\frac{1}{4}$	2.35	3.71
$\frac{1}{2}$	.21	.32	$\frac{1}{2}$	.67	1.05	$\frac{1}{2}$	1.40	2.20	$\frac{1}{2}$	2.38	3.75
$\frac{3}{4}$	.21	.34	$\frac{3}{4}$	.68	1.07	$\frac{3}{4}$	1.42	2.23	$\frac{3}{4}$	2.41	3.79
13	.22	.35	23	.70	1.10	33	1.44	2.26	43	2.44	3.84
$\frac{1}{4}$	.23	.36	$\frac{1}{4}$	.71	1.13	$\frac{1}{4}$	1.47	2.29	$\frac{1}{4}$	2.46	3.88
$\frac{1}{2}$	.24	.38	$\frac{1}{2}$	.73	1.15	$\frac{1}{2}$	1.49	2.33	$\frac{1}{2}$	2.49	3.93
$\frac{3}{4}$	.25	.39	$\frac{3}{4}$	.75	1.17	$\frac{3}{4}$	1.51	2.36	$\frac{3}{4}$	2.52	3.97
14	.26	.41	24	.76	1.20	34	1.53	2.40	44	2.55	4.02
$\frac{1}{4}$	.27	.42	$\frac{1}{4}$	.77	1.22	$\frac{1}{4}$	1.56	2.43	$\frac{1}{4}$	2.58	4.06
$\frac{1}{2}$	.28	.43	$\frac{1}{2}$	.79	1.25	$\frac{1}{2}$	1.58	2.47	$\frac{1}{2}$	2.61	4.11
$\frac{3}{4}$	.29	.45	$\frac{3}{4}$	.81	1.27	$\frac{3}{4}$	1.60	2.50	$\frac{3}{4}$	2.64	4.16
15	.30	.46	25	.83	1.30	35	1.62	2.54	45	2.68	4.21
$\frac{1}{4}$	.31	.47	$\frac{1}{4}$	.85	.32	$\frac{1}{4}$	1.65	2.57	$\frac{1}{4}$	2.71	4.25
$\frac{1}{2}$	.32	.49	$\frac{1}{2}$	.86	1.35	$\frac{1}{2}$	1.67	2.61	$\frac{1}{2}$	2.74	4.30
$\frac{3}{4}$	.35	.51	$\frac{3}{4}$	.87	1.38	$\frac{3}{4}$	1.69	2.65	$\frac{3}{4}$	3.05	4.79

EXAMPLES.

1. A keg is, head diameter $12\frac{1}{2}$, bung $14\frac{1}{2}$, and length 16 inches ; how many gallons does it hold ?

in.	gall.
14.5	$13.6 \times 13.6 \times .0034 \times 16 = 10.06$ Answer.
12.25	By the table
<hr style="width: 50px; margin: 0;"/>	$12.25 = .20$
2.25	$14.5 = .43$
.6	<hr style="width: 50px; margin: 0;"/>
<hr style="width: 50px; margin: 0;"/>	$.63 \times 16 = 10.08$ gal.
1.350	
12.25	
<hr style="width: 50px; margin: 0;"/>	
13.6 equ. diameter	

2. Suppose a hogshead, whose diameters are 24 and 32, and length 40 inches ; how many gallons will it contain ?
 Mul. .65 Answer.....115 gal.

3. What is the content of a cask, whose diameters are $24\frac{1}{2}$, $31\frac{1}{2}$, and length 42 inches ?
 Mul. .65 Answer.....120 gallons

4. A cylinder : See case 3, example 1 ; required the content in gallons by the table ?

$$48 = \left\{ \begin{array}{l} 3.05 \\ 4.79 \end{array} \right\} = 7.84 \times 60 = 470. \text{ gallons.}$$

CASE 6.

To find the quantity of liquor in a cask, part full, lying with its axis parallel to the horizon ;

RULE.

Divide the wet inches at the bung by the bung diameter, continuing the quotient to two figures ; which seek in the annexed table, under V. the number opposite, multiply by the whole content of the cask, for the quantity remaining.

TABLE III.

V	Seg.	V	Seg.	V	Seg.	V	Seg.	V	Seg.
1	.0017	21	.1526	41	.3860	61	.6389	81	.8677
2	.0048	22	.1631	42	.3986	62	.6514	82	.8776
3	.0087	23	.1738	43	.4112	63	.6636	83	.8873
4	.0134	24	.1845	44	.4238	64	.6759	84	.8968
5	.0187	25	.1955	45	.4365	65	.6881	85	.9059
6	.0245	26	.2066	46	.4491	66	.7002	86	.9149
7	.0308	27	.2178	47	.4618	67	.7122	87	.9236
8	.0375	28	.2292	48	.4745	68	.7241	88	.9320
9	.0446	29	.2407	49	.4873	69	.7360	89	.9402
10	.0520	30	.2523	50	.5000	70	.7472	90	.9480
11	.0598	31	.2640	51	.5127	71	.7593	91	.9554
12	.0680	32	.2759	52	.5255	72	.7708	92	.9625
13	.0764	33	.2878	53	.5382	73	.7822	93	.9692
14	.0851	34	.2998	54	.5509	74	.7934	94	.9755
15	.0941	35	.3119	55	.5635	75	.8045	95	.9813
16	.1032	36	.3251	56	.5762	76	.8155	96	.9866
17	.1127	37	.3364	57	.5888	77	.8262	97	.9913
18	.1224	38	.3486	58	.6014	78	.8369	98	.9952
19	.1323	39	.3611	59	.6140	79	.8474	99	.9983
20	.1424	40	.3735	60	.6265	80	.8576	100	1.0000

EXAMPLES.

1. A barrel containing $31\frac{1}{2}$ gallons, is part full; bung diameter $23\frac{1}{2}$ inches; and wet inches 10; how many gallons are there?

$$\begin{array}{r} 23.25 \times 10.0000 (43 = .4112) \\ \hline 9300 \quad 31.5 \end{array} \left. \vphantom{\begin{array}{r} 23.25 \\ 10.0000 \end{array}} \right\} \text{multiply}$$

$$\begin{array}{r} 7000 \text{ gal. } 12.95 \text{ Answer.} \\ 6975 \\ \hline \end{array}$$

25

2. Suppose a hogshead, bung diameter 31.5 inches, wet inches 24.6, whole content 120 gallons; query the contained liquor?
Answer.....100.4 gals.

CASE 7.

To find the content of liquor in a cask, part full, its axis perpendicular to the horizon;

RULE.

Divide the wet inches by the length of the cask, continuing the quotient to three figures. If the quotient do not exceed .250, subtract $\frac{1}{10}$ from it; if between .250 and .750, add $\frac{1}{10}$, and from the sum take .05; if above .750, subtract $\frac{1}{10}$, and to the remainder add .1: the result of either of these, multiply by the whole content of the cask for the quantity remaining.

EXAMPLES.

1. A hogshead, standing with its axis perpendicular to the horizon, is part full; head diameter 24.5 inches, bung 31.5, length 42, and wet inches 14; its whole content 120 gallons: Query the quantity of the contained liquor? Also, the number of gallons the empty part will hold?

$$\begin{array}{r}
 10) \\
 42 \overline{) 11.000} (.262 \text{ near} \\
 \underline{84} \quad \quad 262 \\
 \underline{260} \text{ & c. } 2882 \\
 \underline{260} \quad .05 \\
 \underline{2382} \\
 120 \\
 \hline
 \text{gallons } 28.5840 \text{ Answer.}
 \end{array}$$

$$\begin{array}{r}
 10) \\
 42 \overline{) 31.000} (.738 \\
 \underline{294} \quad \quad 738 \\
 \underline{160} \text{ & c. } 8118 \\
 \underline{160} \quad .05 \\
 \underline{7618} \\
 120 \\
 \hline
 91.4160 \text{ empty part.} \\
 28.584
 \end{array}$$

120. Proof.

2. Length of a cask 40 inches, wet inches 26, whole content 115.5 gallons: what quantity of liquor is there remaining?

Answer.....76.8 gals.

MISCELLANEOUS QUESTIONS.

1. Write out in words, also set down in figures MDCCXCIX.

2. A person was 37 years of age 29 years ago; and if he live 33 years from this time, what will be his age at his death? Answer.....99 years.

3. A merchant, at beginning in trade, owed 578£. he possessed in cash and stock £.5789; in one year's business he cleared £.586: What was his neat balance?

Answer.....£.5797

4. What difference will there be in the ages of two persons, one born in 1746, the other in 18 years hence; the question being put in 1798? Answer.....70 years

5. If the mean distance between the earth and sun be 95 million 173 thousand miles, and between the earth and moon, 240 thousand; how far are these two luminaries asunder at an eclipse of the sun, when the moon is directly between the earth and sun; and how far at an eclipse of the moon, when the earth is in a line between them?

Answer..... $\left\{ \begin{array}{l} \text{of the sun } 94933000 \text{ miles} \\ \text{of the moon } 95413000 \end{array} \right.$

6. What is the difference between six dozen dozen, and half a dozen dozen; what their sum; what their product; and what the quotient of the greater by the less?

difference.....792, sum 936
product.....62208 quot. 12

7. Two persons set out from the same place; one travels east, 27 miles a day, the other goes west 35; how far are they asunder at the end of six days?

Answer.....372 miles

8. Bought 27 pieces of nankeens, each $11\frac{1}{2}$ yards, at 14s. 4d. $\frac{1}{2}$ a piece, which were sold at 18d. a yard; required the prime cost, what sold for, and the gain?

Answer..... $\left\{ \begin{array}{l} \text{Prime cost } 19\text{l. } 8\text{ } 1\frac{1}{2} \\ \text{Sold for } 23\text{l. } 5\text{ } 9 \\ \text{Gain } 3\text{l. } 17\text{ } 7\frac{1}{2} \end{array} \right.$

9. If dolls. 19 50 cents are to be given in charity, each person to have half a dollar; how many applicants were there? Answer.....39.

10. A, B, C and D hold a stock: A, B and C have.

350*£*. B, C and D, 345*£*. C, D and A, 400*£*. and D, A and B, 378*£*.: What is each man's particular share, and the whole stock in trade?

Answer..... $\left\{ \begin{array}{l} A\ 146\text{£}. B\ 91\text{£}. C\ 113\text{£}. D\ 141\text{£}. \\ \text{stock } 491\text{£}. \end{array} \right.$

11. The sum of two numbers is 4189, the difference is 948; what is the least number?

Answer.....1595

12. Received 57953 mills, 4953 cents, 1913 dimes, 187 dollars, and 45 Eagles; what is the whole sum in dollars?

Answer.....935dols. 78cts 3m.

13. If from 187 eagles be taken 1097 dollars, how many dollars are remaining?

Answer.....dols.778

14. A person would exchange 980 French crowns for eagles; how many must he have?

Answer.....107eag. 8dols.

15. In a tier of wood 90 feet long, 5 feet high, how many cords?

Answer.....15 cords

16. A lot of ground is 48 feet in length, and 40 feet in width; what is the value of it, at 20 dollars the square rod?

Answer.....141dols. 4cts. +

17. If 9 persons spend 450 dollars in 5 months, what sum would be sufficient for 8 months, if 5 more be added to the family?

Answer.....1120dols.

18. In what time will money at 5, 6, and 7 per cent simple interest, double itself?

Answer.....in 20 years at 5 per cent.

16yr. 8mo. at 6

14yr. 3mo. 12da. at 7

19. In what time will money, at 5 and 6 per cent, compound interest, double itself?

Answer.....in 14yr. 2mo. 12da. at 5

11yr. 10mo. 21d. at 6

20. In what time will *£*.100, at 6 per cent, compound interest, amount to *£*.1000?

Answer.....37yr. 8mo. 12days

21. The earth revolves round the sun in 365 $\frac{1}{4}$ days, and describes, according to Dr. Stewart, an orbit of 744457824 miles; how many miles in a minute does it move in its orbit; also in a second?

Answer..... $\left\{ \begin{array}{l} 1415 + \text{per minute} \\ 23\frac{1}{4} + \text{per second.} \end{array} \right.$

22. The circumference of the earth is computed to be 25020 miles; now if a ship sail, without interruption, 6 miles an hour; the time of her circumnavigation is required?

Answer.....173 days 18 hrs.

23. Sound flies at about 1142 feet in a second of time, and if 56 seconds be observed between seeing the flash, and hearing the report of a cannon, the distance is required?

Answer.....12 $\frac{1}{2}$ miles.

24. If the interest of a sum for 30 days be £.35 2 10, at 5 per cent, how much is it for the same time, at 4 per cent?

Answer.....£.28 2 3 $\frac{1}{2}$

25. If 4 persons, in every 100, die annually; how many burials a year, in a town consisting of 3625 persons?

Answer.....145.

26. If 40 men, in 16 days, working 10 hours each day, make a turnpike road of 320 poles in length; what distance, of like road, will 50 men make in 120 days, working 9 hours each day?

Answer.....8 miles 3 fur. 20 p.

27. If the interest of 300 dollars for a year be 48 dollars; what is the interest of £.236 for 73 days?

Answer.....dollars 7 55 cents.

28. In an orchard of fruit trees, $\frac{1}{4}$ of them bear apples, $\frac{2}{5}$ pears, $\frac{1}{6}$ plumbs, 60 of them peaches, and 40 cherries; how many trees does the orchard contain?

Answer.....1200

29. A can do a piece of work in 7 days, B can do it in 12 days; working both together, in what time will they finish it?

$$7 \times 12 = 84$$

$$7 + 12 = 19) —$$

4 days 5 hrs. Answer.

30. A can do a piece of work in 20 days, B can finish the same in 40, and C in 120; in what time will they all do it, working together?

$$20 \times 40 = 800$$

$$20 + 40 = 60) —$$

$$13 \frac{1}{3} = \frac{40}{3} \text{ A and B together.}$$

$$\frac{40}{3} \times 120 = 4800$$

$$\frac{40}{3} + 120 = \frac{400}{3}; \text{ inverted } \frac{3}{400}$$

$$\frac{4800}{3} \times \frac{3}{400} = \frac{4800}{400} = 12 \text{ days, Answer.}$$

31. A, B, and C, can complete a piece of work in 12 days; A can do it alone in 20 days, and B in 40; in what time can C do it himself?

$$20 \times 40 = 800$$

$$20 \div 40 = 60) \text{---}$$

$$13\frac{1}{3} = \frac{40}{3} \text{ A \& B together}$$

$$\frac{40}{3} - 12 = \frac{4}{3}; \text{ inverted } \frac{3}{4}$$

$$\frac{40}{3} \times \frac{3}{4} \times \frac{3}{4} = 120 \text{ days; Answer:}$$

32. A certain school is divided into 5 classes, thus; $\frac{1}{16}$ of the boys learn geometry, $\frac{1}{4}$ grammar, $\frac{1}{6}$ arithmetic, $\frac{1}{10}$ learn to write, and 9 to read: Query the number in each class, also of the whole school?

Answer..... $\begin{cases} 5 \text{ geo. } 30 \text{ gram. } 24 \text{ arithm. } 12 \text{ writ.} \\ 9 \text{ read.} \end{cases}$ Whole number 80.

33. If 16 men build a wall 120 feet long, 2 feet broad, and 16 high, in 20 days; how many men will build a wall 100 feet long, 3 broad, and 20 high in 5 days?

Answer.....100 men

34. A cistern can be filled with water from one inlet in 12 hours, and from another in eight; in what time will it be filled by both, running together?

Answer.....hrs.4 48min.

35. What is $\frac{1}{16}$ of a ship's cargo worth, valued at £.1400?

Answer.....£.262 10

36. X, Y and Z, traded together with a joint stock of £.1025.5, and gained at the rate of £.24 per cent; X's share is $\frac{1}{3}$, Y's $\frac{1}{5}$, and Z's the rest: What is each person's gain?

Answer.....X £.123.06, Y £.49.224, Z £.73.836

37. To $\frac{1}{3}$ of a £. add $4\frac{1}{2}$ s, and from the sum take $\frac{2}{3}$ of $\frac{1}{4}$ of a £, and tell the remainder?

Answer.....s.11 9 $\frac{1}{2}$ d.

38. Goods sold for 11s. 9d. which cost 10s. what is the gain per cent at that rate?

Answer.....£.17 10

39. If 300 yards of wall be built in 7 days by 100 workmen; how many men must be added, to finish it in 114 days more, it being 6 miles in circumference?

Answer.....110 men

40. What annuity, to be entered upon three years hence, and to continue 16 years from that time, may be purchased for a bill of £.2000, at 6 per cent. compound interest?

Answer.....£.235 14 2.

41. Three persons purchase a vessel in company, towards the payment whereof, A. advanced $\frac{2}{3}$, B. $\frac{3}{7}$, and C. £.256: what did A. and B. pay each, and what part of the vessel had C?

Answer.....A £.597 6 s., B £.640, C's part $\frac{6}{37}$

42. When first the marriage knot was ty'd

 Betwixt my wife and me,

My age was to that of my bride

 As three times three to three;

But now when ten, and half ten years,

 We man and wife have been,

Her age to mine exactly bears

 As eight is to sixteen:

Now tell, I pray, from what I've said,

 What were our ages when we wed?

Answer..... { Thy age, when married, must have been
 just forty-five; thy wife's fifteen.

43. What will a plantation amount to, for which the purchaser agrees to pay 1s. the first month, 10s. the second, and so on in a ten-fold proportion monthly to the year's end?

Answer.....£.5555555555 10.

44. Suppose one farthing had been put to interest at the creation, (4004 years before Christ,) and continued to the year of our Lord 1800, at 6 per cent. what would it amount to?

Answer.....7s. 3 $\frac{1}{2}$ d.

45. A labourer was hired 60 days, upon condition, that, for every day he wrought, he should receive 3s. 4d. and for every day he was idle, he should forfeit 1s. 8d. at the expiration of the time, he received £.3 15; how many days did he work, and how many was he idle?

Answer.....Employed 35 days, idle 25.

46. In the diurnal rotation of the earth, how far are the inhabitants at the equator carried in one minute?

Answer.....17 miles 3 fur.

47. E. can mow an acre of grass in 7 $\frac{1}{2}$ hours; F. in 8 $\frac{1}{2}$ hours; what time will they require to cut it, working together?

Answer.....4 hours.

48. Seventy-five beats of the artery are usually allowed to a minute: the distance then is required, in which 55 pulsations at the wrist are observed, between seeing the flash of a piece of ordnance, and hearing the report?

Answer.....9 miles 4 fur. 29 yds.

49. If the human heart beat 75 times in a minute, and each pulsation transmits 2 ounces avoirdupois of blood, and the whole blood be $\frac{1}{4}$ part of the weight of the body ; in what time will the whole blood of a man, who weighs 152 lb. circulate through the heart ?

Answer.....2 min. 1 sec. $\frac{1}{4}$

50. A father, on his death bed, left his two sons, (the one 11, the other 16 years old) 10000 dollars, to be divided so, that each share, being put to interest at 5 per cent might amount to equal sums, when they would be respectively 21 years of age : required the shares ?

Answer.....5454 $\frac{8}{11}$ and 4545 $\frac{4}{11}$ dollars.

51. A, plenty of money, proposes to lend B, in need, 500 dollars for a year, providing he will give his bond for a sum, the interest of which, at 6 per cent shall equal the interest of the sum lent at 10 per cent : how much is it ?

Answer.....833 dollars 33 $\frac{1}{3}$ cents.

52. W. lent K. 500 dollars, and took his bond for a sum, such, that its amount, at the year's end, at 6 per cent. was equal the amount of the sum lent at 10 per cent. query the sum specified in the bond ?

Answer.....518 dollars 86 cents.

53. The reservoir of the Philadelphia steam-engine contains 22520 gallons, and can be filled by the engine in 10 minutes : now, supposing, that the average supply of the city will empty it in 40 minutes, what part of the 24 hours must the machine work, and how long at once, without over-running the reservoir ? Also, what quantity of water is daily expended ?

Answer..... $\left\{ \begin{array}{l} 6 \text{ hours in } 24, \\ 13 \frac{1}{4} \text{ min. at once,} \\ 810780 \text{ gal. daily expended.} \end{array} \right.$

FINIS.

CONTENTS.

NUMERATION	Page 1	Decimal fractions	133
Addition of integers	3	Alligation	144
Subtraction of integers	6	Position	147
Multiplication of integers	8	Permutation	151
Division of integers	13	Involution	152
Compound addition	17	Evolution	ib.
Compound subtraction	32	The square root	153
Compound multiplication	37	The cube root	155
Compound division	45	Roots of all powers	157
Reduction	52	Arithmetical progression	161
Single rule of three	59	Geometrical progression	163
Double rule of three	66	Simple interest by decimals	164
Practice	70	Policies of insurance	169
Tare and tret	78	Compound interest by deci.	175
Simple interest	82	Annuities at compound int.	180
Compound interest	100	Annuities, &c. in reversion	188
Rebate or discount	101	Perpetuities at compound int.	192
Equation	103	Perpetuities in reversion	195
Barter	104	Life annuities	196
Loss and gain	106	Duodecimals	204
Fellowship	109	Carpenter & mason's work	208
Exchange	111	Gauging	208
Vulgar fractions	119	Miscellaneous questions	215

UNIVERSITY OF MICHIGAN



3 9015 08431 9737